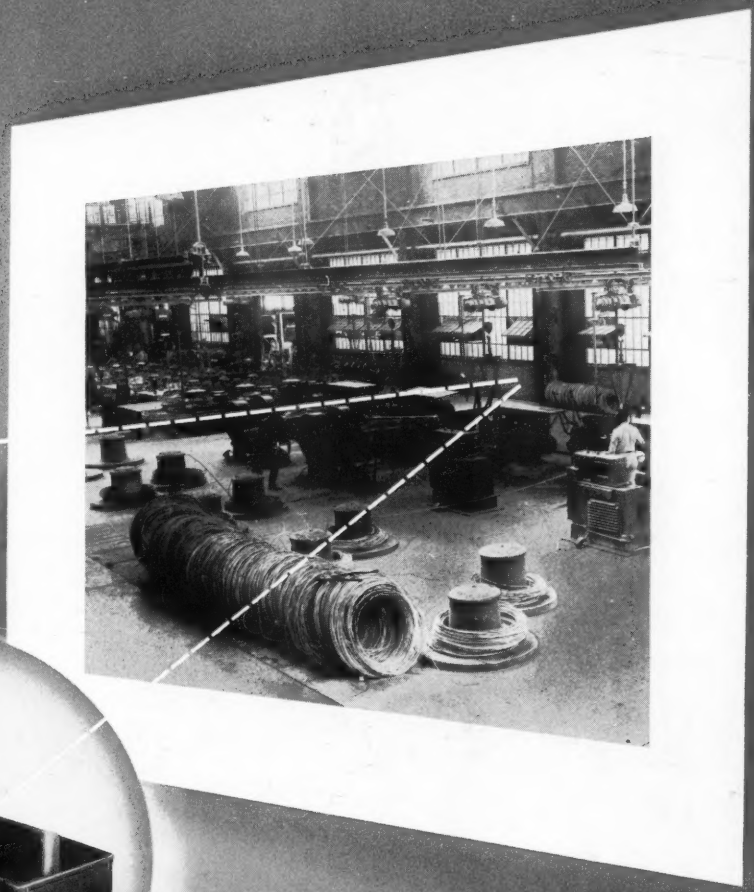
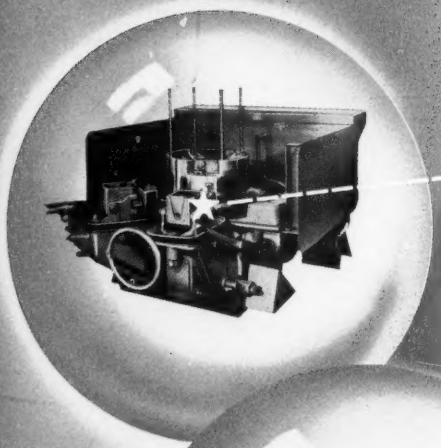
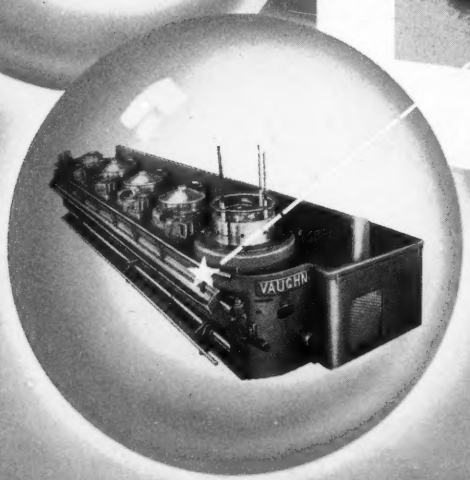
WIRE AND WIRE PRODUCTS

APRIL 1944







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Ready for your Conversion Job Tomorrow

Vaughn Motobloc and Motoblox

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Complete Cold Drawing Equipment... Continuous or Single Hole... For the Largest Bars and Tubes... For the Smallest Wire... Ferrous, Non-Ferrous Materials or Their Alloys.

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HEATED WITH
VERTICAL
RADIANT TUBES

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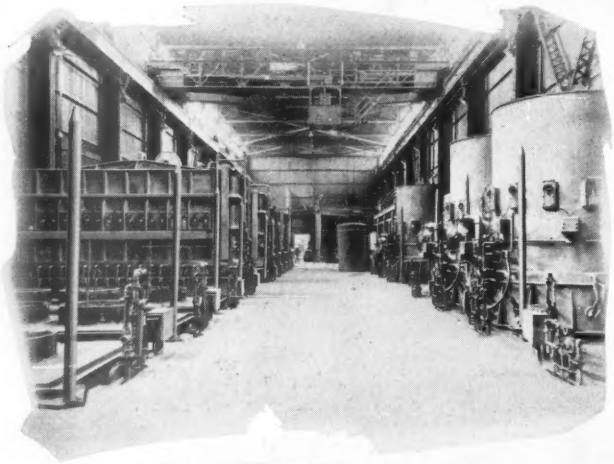
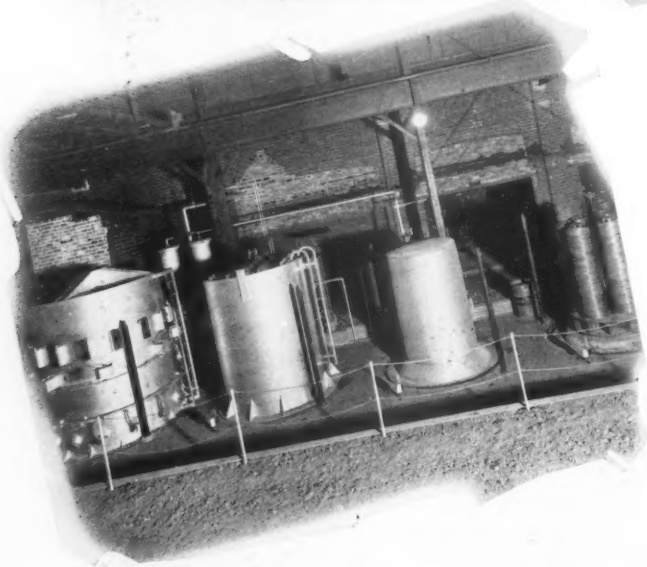
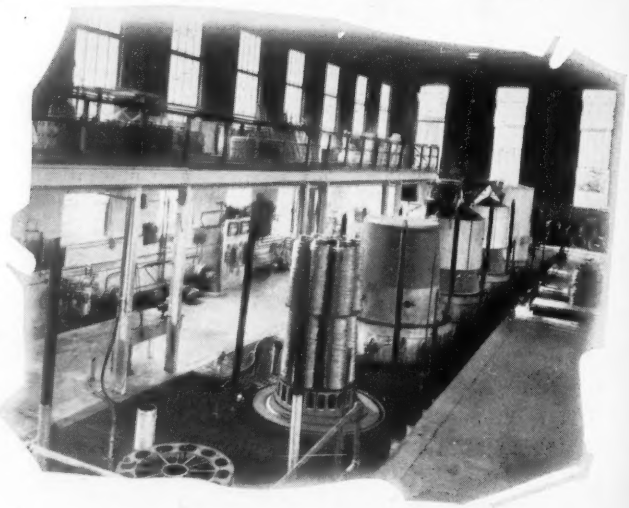
MULTISTACK DESIGN
for
RODS TO FINE WIRE







ENGINEERED AND CONSTRUCTED BY THE

Lee Wilson ENGINEERING Co., Inc.

20005 West Lake Road CLEVELAND, OHIO

Telephone ACademy 4670

The Wilson Annealing Unit is covered by Patents Nos. 1,952,402, 2,068,477, 2,078,356, 2,081,612, 2,089,843, and other patents pending

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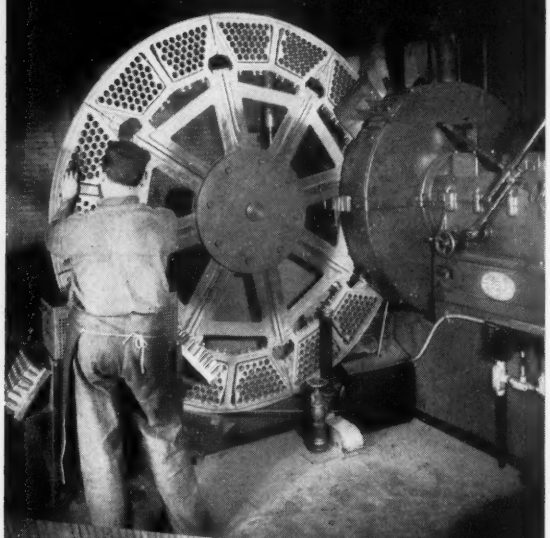
NORTON DISCS . . .
for every Spring Grinding Job



Solid and Segmental Types

Plate and Inserted Nut Mountings

Alundum, 19 Alundum, 38 Alundum and Crystolon Abrasives

Vitrified, Silicate, Resinoid and Shellac Bonds

A Wide Variety of Grains, Grades and Structures

If you are using discs or have a surfacing operation where discs can be used, Norton abrasive engineers will be glad to study your jobs and specify for each the disc that will assure maximum production.

The Norton line of disc wheels is completely described in the booklet "Disc Grinding — A Production Operation". Write for a copy. Just ask for Form 1141-WP.

NORTON COMPANY
WORCESTER, MASS.

W-958

NORTON ABRASIVES

Many are the war production plants that depend on submarine cables to bring them power to keep in high gear. Submarine cables, laid across river-beds and on harbor- and lake-bottoms, are furnishing electrical energy to factories hard at work for the armed forces in many sections of America.

The power-conducting copper wires at the center of a submarine cable are protected by layers of insulating compounds, jute and lead sheathing. The tough long-pitch outer coating is made of steel wire. Supplying corrosion-resisting bethanized wire for armoring cables is one of the many war jobs of Bethlehem's wire mills.

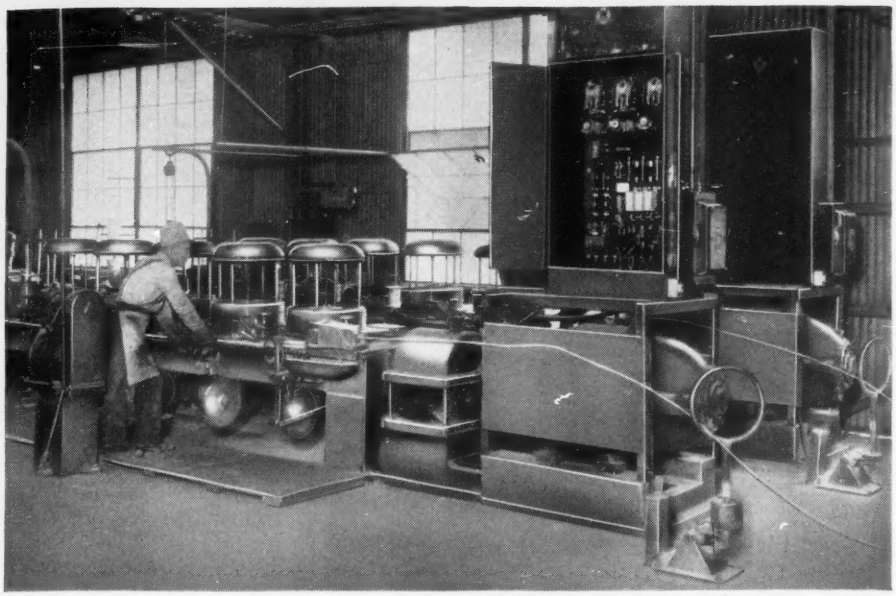
By the bethanizing process a coating of 99.9+ per cent pure zinc is applied to the steel base by an advanced electrolytic method. Bethanized wire has maximum resistance to corrosion as a result of the high purity of the bethanized coating, and its uniformity both around and along the wire. Because the zinc is fastened to the wire atom by atom, there can be no thin spots in the coating to give rust a start. And bethanized wire is so highly ductile that it can be bent and twisted—even drawn through dies to very fine gage—without harming the coating in any way.

Bethanized wire is engaged in many other war jobs—from the making of zippers for fliers' jackets to providing extra strength for field telephone lines. Post-war uses of bethanized wire may far exceed all previous ideas as to possible uses of zinc-coated wire.

★ ★ ★ BETHLEHEM STEEL ★ ★ ★

BETHLEHEM STEEL COMPANY, Bethlehem, Pa.
Bethlehem Steel Export Corporation, New York City

NEED A "TAILOR-MADE" DRAWING COMPOUND?

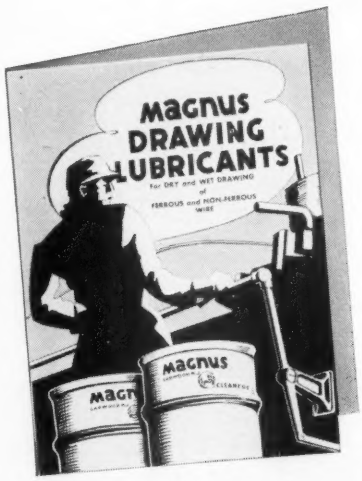


Let Magnus Develop It For You!

Whether you draw steel, stainless, copper or any other wire, by wet or dry methods, the need for greater and greater production speed with maintained quality of finish, has probably made you wish that you had a better drawing compound for your work.

There are so many tough drawing jobs where the lubricants on the market just do not come up to expectations. That is where "tailor-made" comes into the picture. We are ready to work out a satisfactory solution to any of your tough drawing problems, if you'll put them up to us. Our laboratory and long experience in developing special compounds for individual wire drawing operations will give you results.

Of course, the regular Magnus line of wire drawing compounds is made up of time-tested and proven lubricants which meet many a difficult drawing problem.



Write for a copy of this complete bulletin, covering the Magnus line of wire drawing compounds.

For Example:

Magnus 52C-1 is an unusually effective lubricant in multi-pass drawing of high carbon steel wire. It gives much greater production speed—carrying through perfectly on seven passes at a rate of 750 feet per minute. As a matter of fact, many mills keep a stock of 52C-1 on hand for use on their toughest drawing problems, not only in high carbon steel, but on stainless and other metals. It will pay you to investigate 52C-1.

MAGNUS CHEMICAL COMPANY
188 SOUTH AVENUE GARWOOD, N. J.

Representatives in Principal Cities

Magnus WIRE DRAWING COMPOUNDS

Wire taught to do handsprings . . . for you!

● Rapid changes in materiel requirements for our armed forces may have started you working on plans for reconversion to peacetime products. If those plans call for the use of steel wire we can render valuable assistance.

Customers compliment our metallurgists and laboratories for their ability to solve tough wire problems. They've not only found answers to unusual wire applications for many war products (which can also serve industry), but back of them is an institution which for 123 years has been a pioneer in the development of high quality steel wire in all its many forms.

Operation of our own blast furnaces, open hearths and wire mills enables us to control production from ore to finished product. This is your assurance that specifications will be met and that each lot will be uniform in quality, low in cost.

Whether you order in minimum quantity or carload lots, we can meet your needs for high or low carbon steel wire, round, flat or shaped, in a variety of sizes, tempers, grades and finishes. Let us have your specifications.

Send your wire questions to

WICKWIRE SPENCER STEEL COMPANY

500 FIFTH AVENUE, NEW YORK (18), N. Y.

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STANDS FOR FRIENDLINESS

STANDARD INDUSTRIAL COMPOUNDS

Seventy Series

WILL SOLVE TOUGH DRAWING PROBLEMS FOR YOU

WHILE we continue to make Formula No. 70 for Stainless Steel, as announced in the December '43, issue of Wire & Wire Products," Page 758, we have found that by using the base formula and changing the combination of ingredients we obtain special properties to meet certain requirements of closely associated "musts" in wire drawing practice.

New Formula No. 73 is developed especially for the first hole dry drawn on a wet machine.

Other "Seventy" numbers will appear in the series as further experiments are conducted and definite improvements secured.

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No. 73—Dry Hole, Preliminary to Wet Finishing.

No. 77—High carbon patented rod or wire.

We will welcome inquiries bearing on your mill practice and possible improvements in it. If you are not getting the "lease of life" from your dies which you think you should, it may pay you to consult us on further developments of this "Seventy Series." Longer life of dies and specific improvements in the product are the twofold aim of this particular series of our formulas.

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4600 W. FERDINAND STREET, CHICAGO 44, ILLINOIS

Standardize with Standard

Standardize with Standard

WAR NEEDS *Cable*

FOR THE VOICE and POWER for *VICTORY*

Cable for electricity . . . cable to carry power to the machines that turn out tanks, shells, guns . . . cable for ships . . . cable for communications and planes . . . cable for everything it takes to win this war.

Well, "This War" is being won . . . "This War" is getting cable . . . and it'll continue to get cable.

Robertson's Lead Encasing Equipment is literally pushing out war-necessary cable and hose night and day at Roebling, Goodyear, General Cable, General Electric, Western Electric, U. S. Rubber, Anaconda, Goodrich, Swan, Boston, Paranite, Northern Electric and many others.

Collyer Insulated Wire Co. tells the world what they are doing with Robertson Equipment — a recent advertisement.

Lead Pipe and Tube Extrusion Presses — Lead Hose Encasing Presses — Hydraulic Pumps — Melting Furnaces and Pots — Hydro-pneumatic Accumulators — Lead Sheath Stripping Machines and dies and cores.

JOHN Robertson
COMPANY INCORPORATED

125-135 WATER STREET, BROOKLYN 1, NEW YORK

Designers and Builders of all Types of Lead Encasing Machinery

Since 1858

Announcing

a complete line of . . . .

STRANDING and CLOSING machinery

Tubular . . . . . Rigid . . . . . Planetary

The Syncro complete line of wire machinery includes tubular, rigid and planetary (geared or crank type) stranding machines. These machines are built for any combination and size of reels, and for processing all types of electric and wire rope constructions.

Syncro's intensive field study of the requirements of the wire industry is clearly reflected in these machines, which incorporate all of the latest advances, such as spool safety latches, anti-friction bearings, quick change gear boxes and high speed jute serving and taping heads where needed.

Your requirements will be completely met by Syncro scientifically engineered equipment.

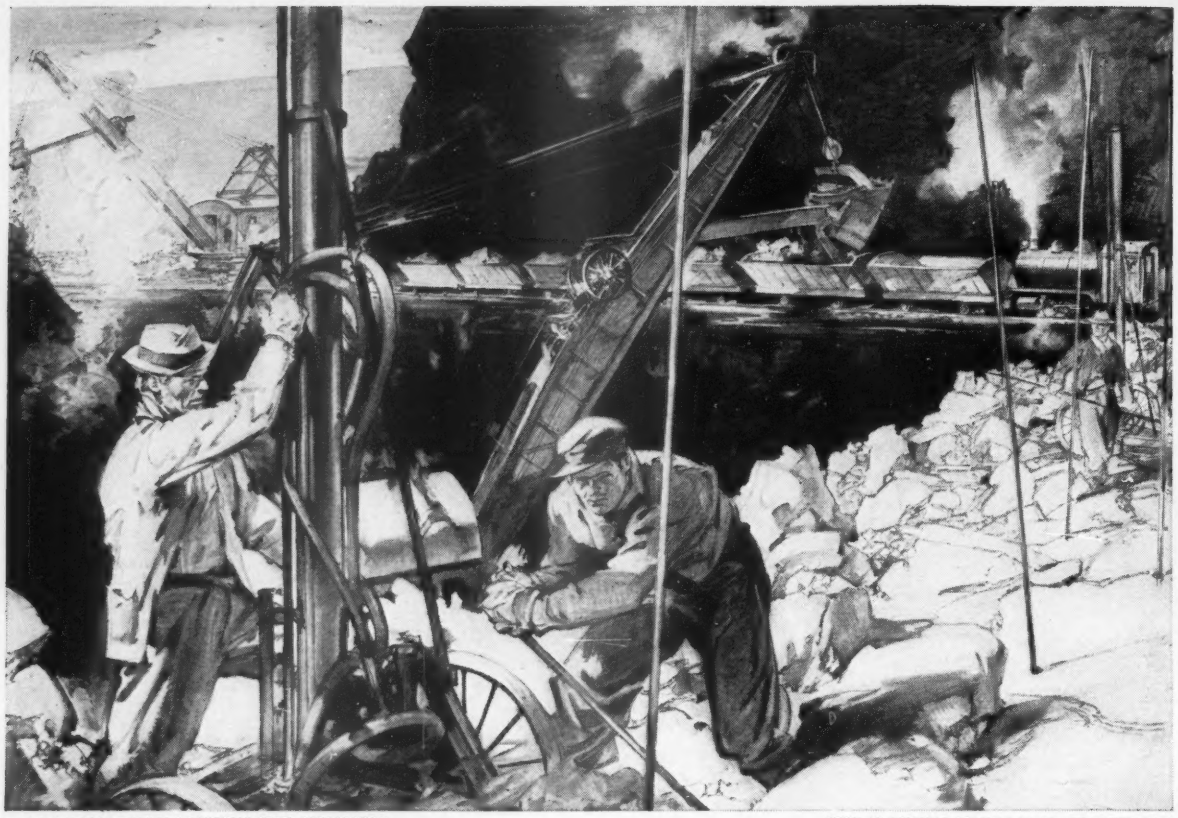
SYNCRO MACHINE COMPANY

RAHWAY, NEW JERSEY
McCORMICK BLDG., CHICAGO

REPRESENTED IN CANADA BY CANADIAN ELEVATOR EQUIPMENT CO. LTD., TORONTO

Machinery for the Wire Industry

SYNCRO



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FROM AN ORIGINAL DRAWING BY ORISON MACPHERSON

STONE SERVES TO MAKE STEEL

Stone was used in warfare when men fought with slings and catapults. Stone serves in modern warfare, too, in the form of scientifically quarried, graded and analyzed limestone, which, in the blast furnaces frees iron of impurities and in the steel furnaces absorbs unwanted elements.

This modern use of limestone — 30 million tons in 1943 — contributed to production in America of 90 million ingot tons of steel for invasion—the greatest production of steel the world has ever known.

As soon as the war is won, this production of steel—much of it newer, more versatile steels—will be available for the great volume of everyday articles waiting to be manufactured for peacetime use.

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH, PENNSYLVANIA

J&L STEEL

CONTROLLED QUALITY STEEL FOR WAR

J&L STEEL

Fiberglas Yarns are available on serving packages, cones and both straight-edge and streamline braider packages . . . single- or multiple-end windings.

FIBERGLAS* YARNS

now available!

(Increased production permits this announcement to be made)

For application to Magnet Wire and Braided Wire and Cable . . .
Also, Fiberglas Tension Cord and Fillers for many uses . . .

FIBERGLAS

*T.M. REG. U.S. PAT. OFF.

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ELECTRICAL INSULATION

THE WORCESTER REGIONAL MEETING

of The

WIRE ASSOCIATION

Will be Held on

Friday, April 14, 1944 at 6 P. M. at the BANCROFT Hotel

You Are Cordially Invited To Attend This Conference

You will have an opportunity to hear two speakers well qualified to convey ideas of information and importance:

REAR ADMIRAL WATT TYLER CLUVERIUS, United States Navy (Retired), President of the Worcester Polytechnic Institute, will be our guest speaker. Out of the richness of a distinguished career in the Navy and the fullness of his experiences as head of this outstanding educational institution, you can expect some observations worth coming a long way to hear.

MATTHEW J. DONACHIE, Technical Director of Production for the Beryllium Corporation of Pennsylvania, Reading, Pa., whose years of service to the wire industry as a metallurgist have made him well known to us all, will discuss that new wonder alloy, beryllium copper, giving us a picture of its properties, uses and — headaches, when converted into wire. Don't miss this technical paper. A discussion will follow.

The meeting will close with a realistic and thrilling Navy motion picture — "Battle of the Beaches."

An informal get-together is planned for 6 P. M. with
DINNER at 6:30 P. M. at the BANCROFT

The Registration Fee — $3.00 — Includes Your Dinner

Make your room reservations now with the Bancroft Hotel if you plan to remain overnight. And please advise us whether you will attend and how many guests you will bring, as we have to arrange with the hotel management as to the number to be accommodated for dinner.

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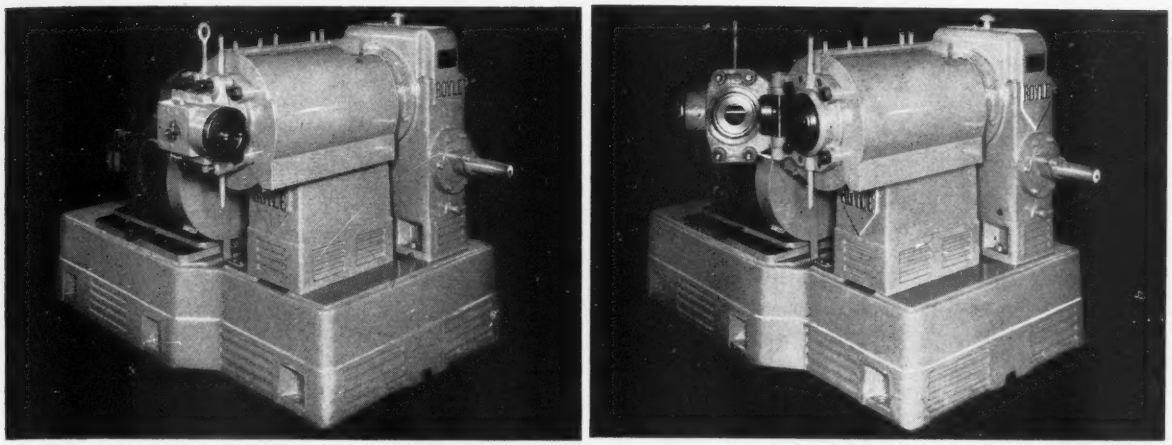
BUILT FOR YEARS OF SERVICE



NO. 2 ROYLE PLASTICS INSULATING MACHINE

Recently we received an inquiry from a customer who wanted to know if certain alterations could be made to one of their tubing machines. A check of our records revealed that the machine in question was delivered in July 1893—nearly fifty-one years ago.

It is encouraging to know that in these days of "use it up—wear it out" there are Royle oldtimers still capable of doing their bit on the "production front".

Today, as always, our skills are devoted to designing and building continuous extrusion machines to meet the specific requirements of the application involved.

JOHN ROYLE & SONS

ROYLE — PATERSON N. J. — ARMY E NAVY

PIONEER BUILDERS OF EXTRUSION MACHINES SINCE 1880

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"Standard" ROLLING MILLS

"Specify Standard"

Two-, Three-, or Four-High Mills with Rolls from 1½" to 16" diameter and from 3" to 18" face.

Two-High Heavy Duty Roller Bearing Mill

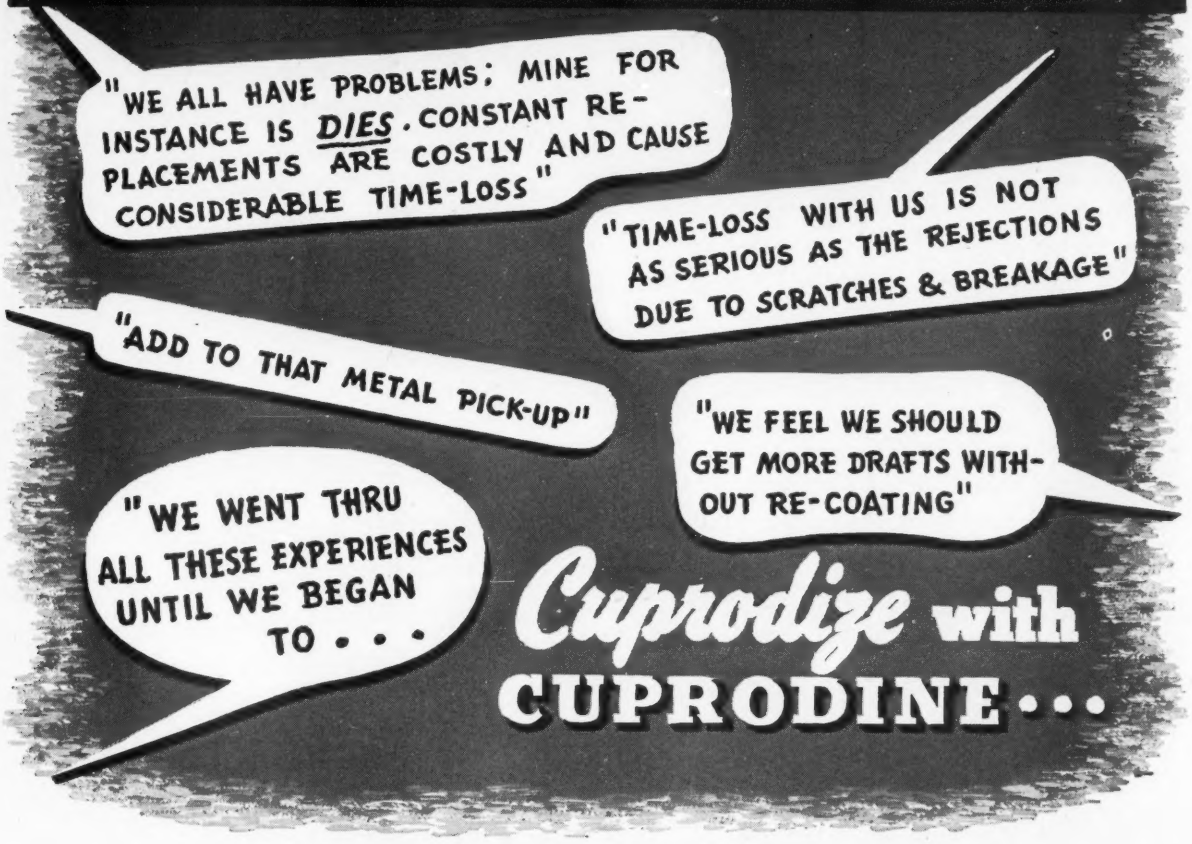
Available for:

- Hot and cold rolling of metal strip, rod and ingot
- General sizing and embossing
- Precision rolling of strip
- Grading
- Cross and pinch rolling
- Forming wire to exact dimensions
- Single or tandem rolling

Write for Catalog R M

STANDARD MACHINERY CO.
PROVIDENCE 7, RHODE ISLAND

WHY CONTINUE WITH DRAWING TROUBLES?


"WE ALL HAVE PROBLEMS; MINE FOR INSTANCE IS DIES. CONSTANT RE-PLACEMENTS ARE COSTLY AND CAUSE CONSIDERABLE TIME-LOSS"
"TIME-LOSS WITH US IS NOT AS SERIOUS AS THE REJECTIONS DUE TO SCRATCHES & BREAKAGE"
"ADD TO THAT METAL PICK-UP"
"WE FEEL WE SHOULD GET MORE DRAFTS WITH-OUT RE-COATING"
"WE WENT THRU ALL THESE EXPERIENCES UNTIL WE BEGAN TO . . .
Cuprodize with CUPRODINE . . .

"We have found CUPRODINE to be the ideal lubricant for us—let me tell you why:

"CUPRODINE is more than a lubricant. When it copper coats (without current) it reacts with the steel, dissolving minute quantities to form a thin, adherent copper coating. The microscopic points present on steel surfaces are dissolved and a smooth coated surface remains which will not mar or scratch the face of the die.

"You'll find scratches reduced because on Cuprodized metal there are no tiny points left to fuse to the face of the die and cause scratches. Proper lubrication also minimizes pick-up.

"We find that wire or other products withstand more drafts when Cuprodized than when coated with the usual acid copper or the soap solutions."

CUPROTEK is a new chemical aid in metal finishing which protects, from rust or corrosion, products which have been Cuprodized or copper plated, should it be necessary to store or ship these coated materials before drawing.

The ACP technical department will gladly advise with you and recommend the method and grade of CUPRODINE that is best suited to meet your requirements.

Write for Technical Service Data Sheets.

Manufacturers of Inhibitors & Metal Working Chemicals

AMERICAN CHEMICAL PAINT CO.
AMBLER ACP PENNA.

Note: West Coast Plants may address inquiries and orders for prompt delivery to: Leon Finch, Ltd., 728 East 59th St., Los Angeles, Calif.

CHEMICALS ACP PROCESSES

American Chemical Paint Company, Ambler, Pa.
Please send me general Technical Service Data Sheets on
☐ Cuprodine ☐ Cuprotek

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*Company*_____
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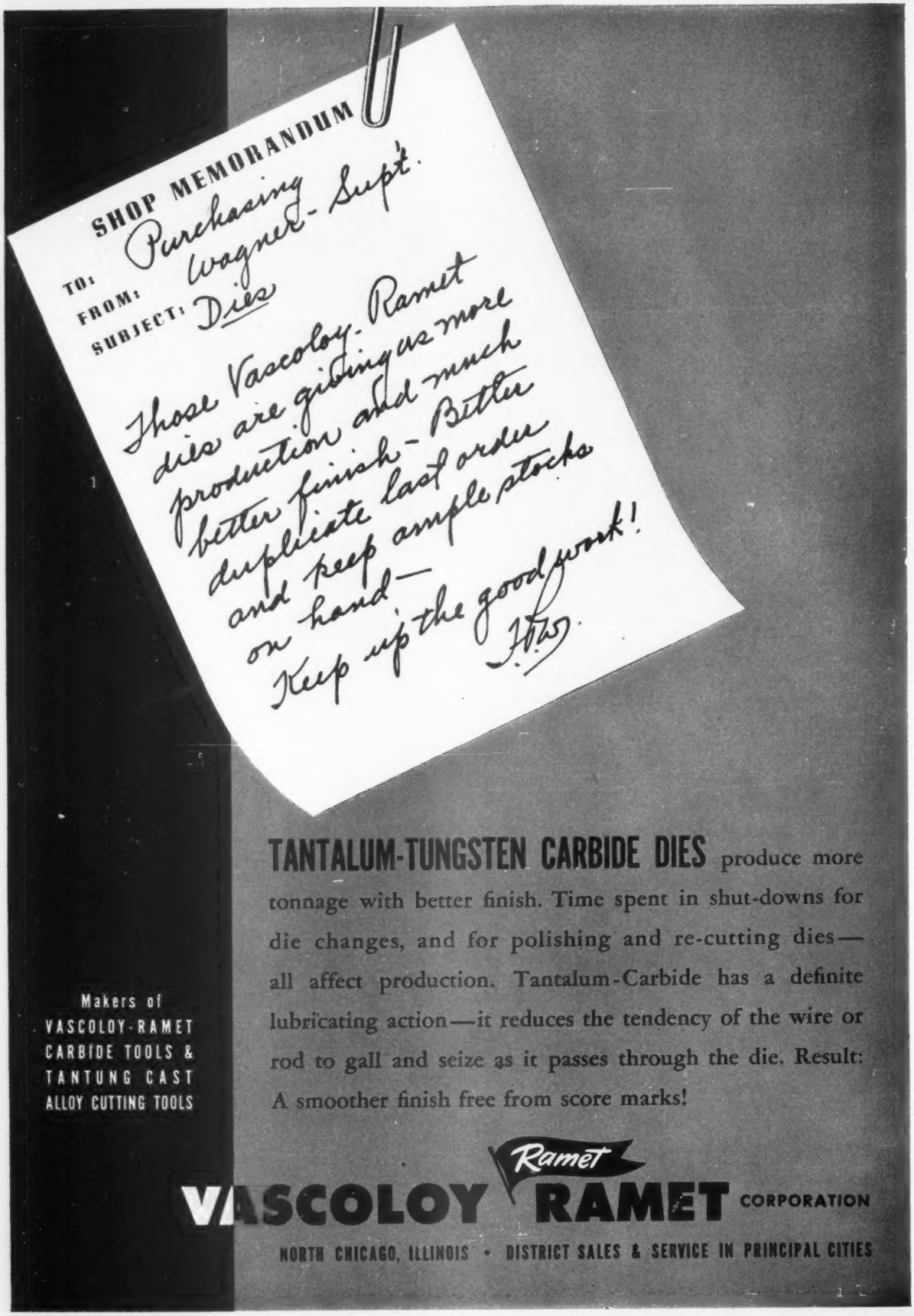
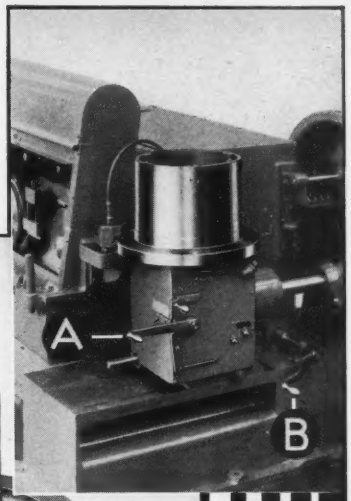
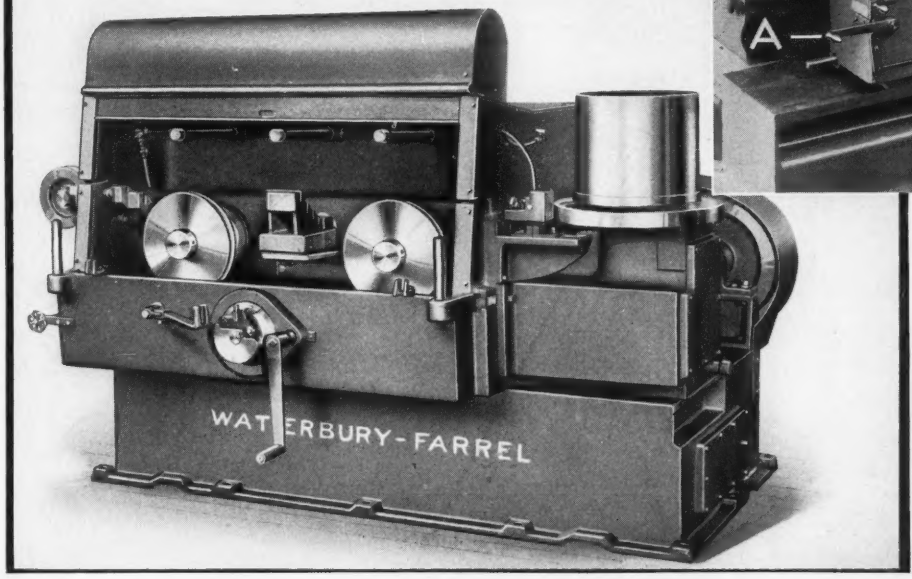

SHOP MEMORANDUM
TO: Purchasing
FROM: Wagner - Supt.
SUBJECT: Dies
Those Vascoloy-Ramet dies are giving us more production and much better finish - Better duplicate last order and keep ample stocks on hand —
Keep up the good work!
J.W.S.
TANTALUM-TUNGSTEN CARBIDE DIES produce more tonnage with better finish. Time spent in shut-downs for die changes, and for polishing and re-cutting dies — all affect production. Tantalum-Carbide has a definite lubricating action — it reduces the tendency of the wire or rod to gall and seize as it passes through the die. Result: A smoother finish free from score marks!
Makers of VASCOLOY-RAMET CARBIDE TOOLS & TANTUNG CAST ALLOY CUTTING TOOLS
Ramet
VASCOLOY RAMET CORPORATION
NORTH CHICAGO, ILLINOIS • DISTRICT SALES & SERVICE IN PRINCIPAL CITIES

WIRE DRAWING MACHINES





FOUNDED WATERBURY FARREL 1851

by WATERBURY-FARREL

WITH WIRE BLOCKS WHICH *rotate in either direction*

Upright Cone Continuous Machines with provision for quickly changing the rotation and position of block.
Two conveniently located removable handles do the trick in jig time—

A — changes direction of rotation
B — shifts position of block - - -

The machines are available with blocks of various diameters or with spooling devices. Our wire drawing machinery is described in Catalog W.

• WIRE AND ROD MACHINERY • COLD HEADING MACHINERY, ETC. •

WATERBURY FARREL
FOUNDRY & MACHINE COMPANY
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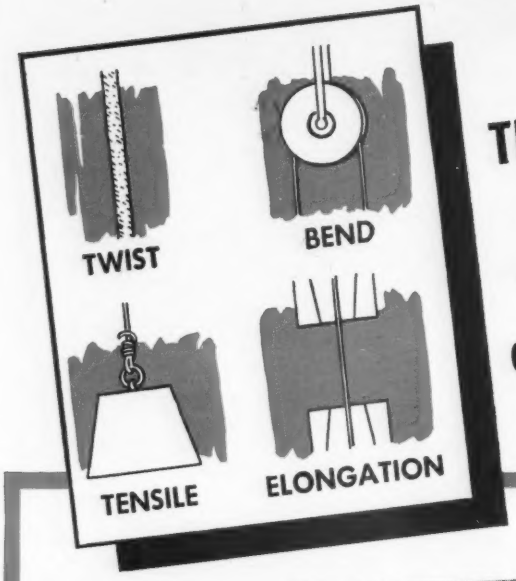
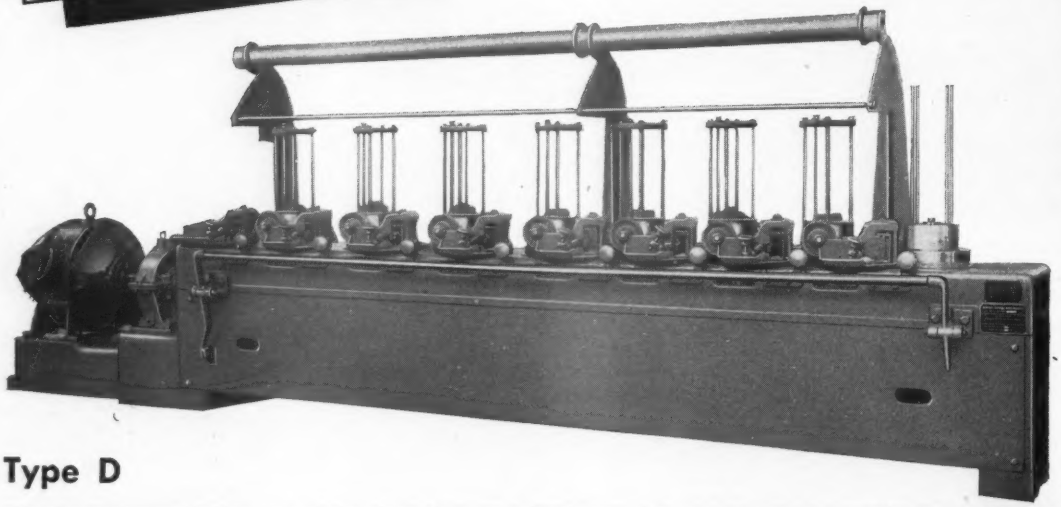


These Tests are Met with Wire

Drawn Dry

on a MORGAN-CONNOR Wire Machine



Type D

For Rope Wire in Sizes .028" to .009"
Dry Drawn • No Slip
5, 6, 7, 8 or more Drafts
Ample cooling for high speed drawing
Draw from welded bundles

MORGAN CONSTRUCTION COMPANY • Worcester, Massachusetts

W-96

PLAN NOW WITH MORGAN

WIRE DRAWING MACHINES

WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 19 APRIL, 1944 No. 4

Designated as

Official Publication By The Wire Association

Contents

Decarburization Control With Nitrogen Gas Atmosphere in Alloy Steel Annealing ..... By Julius L. Kozma 227

The Drawing of Synthetic Fibers ..... By Sydney Coppick 238

Postwar Recommendations ..... By Frances Perkins 242

Wire Drawing in Scotland 259

Government Wire Production Information 243

A Review of Recent Wire Patents 254

Index to Advertisers 268

Where to Buy 269-272

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Lancaster, Allwine & Rommel, Consultants on Patent Information

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Publication Office: Washington, N. J.
Executive Office: Stamford Trust Co. Bldg., 300 Main St., Stamford, Conn.

Annual Subscription, U. S. $5.00, Canada $5.00

50 Cents a Copy in U. S. Issued Monthly Foreign, $7.50

October Convention Issue $1.00 a Copy

January Convention Discussions Issue $1.00 a Copy

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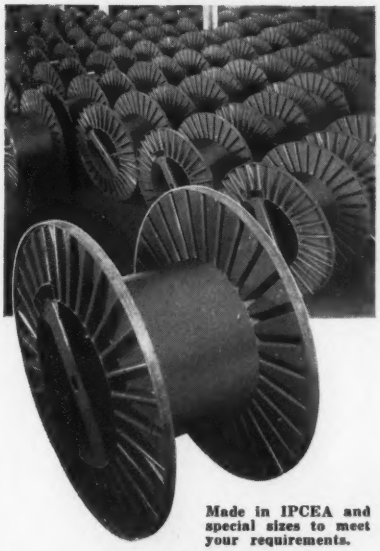

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Vol. 19 APRIL, 1944 No. 4

Decarburization Control With Nitrogen Gas Atmosphere In Alloy Steel Annealing

By Julius L. Kozma,
Project Engineer, Lee Wilson Engineering Co., Inc.,
Cleveland, Ohio.

A summary of the research and development work in the use of nitrogen atmospheres for annealing high carbon and alloy rod and wire coils to hold decarburization to a minimum. ✦ ✦ ✦ ✦ ✦ ✦

IN the last few years, particularly those since the war started, many manufacturers of alloy and high carbon steels in bar, rod and wire form, have been very seriously confronted with the problems of surface decarburization in their annealing practice. Those who had previously been engaged in the production of alloy and high carbon steels were not greatly handicapped as they were properly equipped with both furnaces and atmosphere producing equipment and had established successful methods of practice. But those upon whom the war had suddenly thrust a great demand for alloy steel production, were greatly handicapped in the production of this type of material in respect to the treatment and annealing processes concerned, for the following reasons:-

1. **Lack of proper furnace equipment suitable for use with controlled atmospheres to prevent decarburization**
2. **Lack of proper atmosphere gas generating equipment suitable for alloy and high carbon steels**
3. **Lack of proper knowledge and experience in dealing with problems of decarburization**

JULIUS L. KOZMA

Born March 14, 1907 in Crescent, Ohio. Attended schools in Youngstown, Ohio. Graduated from Tri-State College in 1930 with Bachelor of Science degree in Mechanical Engineering. Employed in Engineering Department of the Carnegie-Illinois Steel Corp., Ohio Works, at Youngstown, Ohio, from 1930 to 1937. With Republic Steel Corp., Cleveland, Ohio, at the Corrigan-McKinney Engineering Dept., and 98" Strip Mill Metallurgical Laboratory from 1937 to 1939. Became associated with the Lee Wilson Engineering Co., Inc., in 1939, serving as design, field and project engineer on bell type annealing, furnaces and protective atmosphere equipment. Registered Professional Engineer, State of Ohio.

4. **Lack of adequate time to prepare and establish a successful operating practice**

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WHILE there are several different types of atmosphere and gas generating equipment sold and used to prevent further depth of decarburization on alloy and high carbon material during the various annealing processes, one that is very rapidly coming into use and approaching the lead in this field, is dry nitrogen gas. This nitrogen is not to be confused with pure or 100% nitrogen, which is used mostly as a protective atmosphere in laboratory work only and very seldom in the production field. The gas discussed in this treatise is termed Monogas, in which are small percentages of carbon monoxide and hydrogen, with the balance nitrogen. The necessity for these other gases, and the percentage control required, shall be explained later on.

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IN the use of Monogas, as well as with some of the other protective atmospheres intended to

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prevent further decarburization, possible failure may result in their holding of decarburization at a minimum. This failure in ultimate results, may be due to the following reasons:—

1. **Improper design of the gas atmosphere equipment in respect to application**
2. **Not the proper atmosphere for the type of work it is to be used for.**
3. **Proper atmosphere, but constituent gases of improper proportions or ratios**
4. **Furnace or muffle not of proper type or design for use with such atmospheres**

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IT is particularly for the users and operators of equipment who may belong to this group, that this article is written, so that they may obtain full usefullness of the equipment and turn out a better product of high carbon and alloy steels which are so important and vital to the war effort. Producing these products in the utmost stages of perfection, is, today, vitally important.

✦ ✦ ✦

Monogas

THE nitrogen gas atmosphere being discussed in this paper is produced by the combustion of any of the common fuel gases in a refractory lined, gas tight combustion chamber, with an air to gas ratio slightly on the reducing side. This air-gas ratio is controllable over a wide range, the products of which may range from oxidizing to strongly reducing. The fuel gas used or combusted in the tests outlined in this paper, and collectively shown in the data table Fig. 3, was natural gas. The ratio of air to gas being approximately 9:1 with the analysis and composition of the constituents in the combustion reaction being as follows:

Carbon Dioxide (CO_2) = 10.2%
Oxygen (O_2) = 0.0%
Carbon Monoxide (CO) = 2.2%
Hydrogen (H_2) = 2.2%
Methane (CH_4) = 0.0% (or just a trace)
Nitrogen (N_2) = 85.4% (balance)

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THE dew point or content of water vapor is equivalent to saturation at 96°F., at which temperature the gas leaves the water cooled surface condenser where the bulk of water vapor is removed.

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WITH an air-gas ratio to give an analysis as given above, to contain from 2.0 to 3.0 percent CO, the atmosphere is suitable for practically all ranges of the common alloy and carbon steels and in/or near equilibrium with them at annealing temperatures.

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NITROGEN atmosphere with such a total percentage of combustible gases, CO and H_2, is non-combustible and non-explosive, and for this reason, very safe in handling, as compared to the H_2:N_2 and CO_2: CO atmospheres, which are combustible and, at certain limits, very explosive.

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IN some applications where no combustibles for carbon balance are required, as in brass or other non-ferrous annealing, nitrogen gas is neutral and inert, and, in this state, is totally or nearly 100% N_2.

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Applications For Monogas

MONOGAS is suitable for practically all finishes of products. It can be used on hot-rolled material where finish or surface is of no concern, and also on cold-drawn or rolled material where only a scale free surface is required. Where a bright finish on bright material is required, the material should not be exposed to air after annealing until a safe uncovering temperature is reached, and then the bright surface characteristics compare favorably with the finishes produced by atmospheres intended primarily for bright annealing.

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Decarburizing Gases

THE three most common decarburizing gases encountered in protective atmospheres are:—

1. **Carbon Dioxide**
2. **Water Vapor**
3. **Oxygen**

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THE nitrogen gas atmosphere generated in the combustor or generator of which the constituents are listed above, requires further processing for the removal of these decarburizing constituents.

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CO_2 Removal

THE atmosphere is generated in the combustor and leaves the surface condenser, where the bulk of the H_2O is removed. The gas then passes through a tall cylindrical column, known as the CO_2 absorbing tower. This tower is filled with small refractory tubes, which, in total, have great surface area.

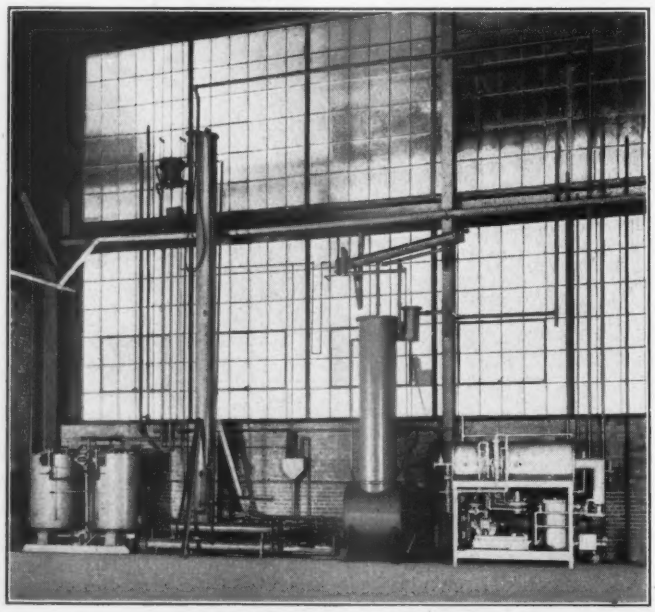

Fig. 1. Nitrogen Gas Generating and Drying Equipment.

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A solution of water and absorbing liquid chemical, known as mono-ethanol-amine, of required concentration and rate of flow, is passed down along the surfaces of refractory tubes. This solution enters the absorbing tower near the top through a spray head, and the incoming gas enters near the bottom and passes upward or counter to the flow of the solution, which is called amine. By the time the movement of the gas containing the CO_2 has reached the top, passing through and between the loosely filled tubes wetted with amine, the CO_2 has been absorbed from the gas.

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Drying or Moisture Removal

ALTHOUGH one decarburizing constituent, CO_2, has now been removed in the CO_2 absorbing tower, we still have H_2O to remove, to render the gas non-decarburizing. The gas, for drying purposes, is passed through a dual type of activated alumina dryer. These towers, two in number, are filled with alumina (AL_2O_3). The gas passes through one tower at a time with the alumina absorbing moisture or water vapor out of the gas. After leaving the CO_2 absorbing tower, the atmosphere gas is cooled in the second surface condenser, and enters the alumina dryer saturated at a temperature of about 72°F. By means of this activated alumina dryer, it is possible to dry the gas to a dew point of -50°C. Using electric refrigeration before the alumina dryer, it is possible to dry to dew points of -60°C to -65°C, at which the percentage of water vapor is practically zero. The dried atmosphere gas is then passed through a pressure regulator to maintain constant pressure in the header line. From there, it is piped into the furnaces. The rate of flow is governed by an orifice plate in the supply line to the base or furnace.

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Regeneration of CO_2 Absorbing Solution

IN the earlier types of CO_2 removal equipment, the regenerative principle was not used. At that time, dual towers of absorbing solution were used, often a caustic solution of NAOH. When the absorbing solution approached the point of saturation and failed to remove all CO_2, the gas was bypassed through the second or fresh tower, while the first was drained and refilled with fresh solution. In this method, the process of removing all traces of CO_2 was not too safe or accurate, which, of course, necessitated frequent attention and changing of absorbing solution.

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WITH the equipment now used and herein described, complete removal of CO_2 is possible and saturation of the solution does not take place. This is known as the regenerative type, in which the flow of amine solution is always in circulation and the CO_2 stripped from the absorbing solution.

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THE amine solution is stored in an electric or steam heated boiler, which is maintained at boiling temperature, 212°F. The regeneration, or stripping of the CO_2 from the absorbant takes place in the stripper tower, which is a vertical extension of the boiler. The hot solution, in vapor form, rises from the boiler and passes through refractory tubes or rings, with which the tower is filled. The spent solution, in turn, drips down from the spray head and is vaporized. In this state, it reverses its flow direction to upward and enters a surface condenser, from which the condensed amine solution is returned back into the boiler. The CO_2 vapor goes on through a vapor separator, from which it is discharged to the outside.

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THE amine solution is circulated by means of two centrifugal type pumps, of about 20 G.P.M. capacity. One pumps the fresh solution into the absorbing tower and the other pumps the spent solution back into the stripper tower for regeneration. A flowscope is used to indicate the flow rate of circulation, which is between 1.5 and 12.0 G.P.M., depending on the capacity of the unit.

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ALTHOUGH the piping system may cause the equipment to appear complicated, when seen for the first time, it is quite simple in construction and operation, requiring very little attention and maintenance.

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Furnace Equipment

THE use of nitrogen as an atmosphere can only be used with good results in positively gas tight sealed furnaces. Of these, the bell type, with separate alloy inner covers, is the most suitable, as it can be considered gas tight. The inner cover is

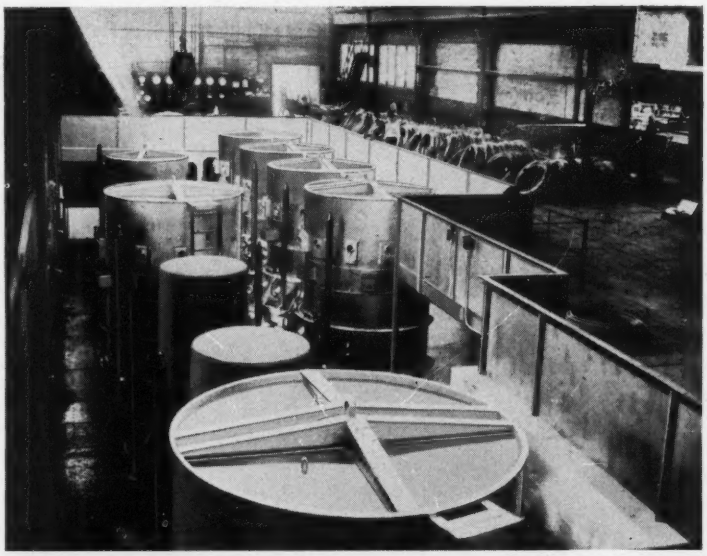

Fig. 2. Cylindrical Bell Type Furnace Installation for Spheroidizing Rod Coils. ✦

sealed up by its immersion in a liquid seal, usually a high flash point oil. Water seals for the inner cover should not be used, as the water will evaporate, causing vapor formation inside of the inner cover. This will result in reactions and possible decarburization.

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THESE seals are troughs around the base of a bell type furnace. In many cases, two are built, the inside one for oil and the outer one for water. With this type of base, the inner cover also has a double seal skirt, which is immersed into each seal. The water may be circulated and used to keep the oil cool at high temperatures, if necessary, but does not contact the inner atmosphere.

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FOR best results, the refractory materials are, in many cases, covered with a sheath of alloy metal, leaving no internal surfaces of exposed brickwork, thereby eliminating the possibility of gas reactions with the refractory materials.

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THE use of alloy inner covers and covered base brickwork also has the important advantage of eliminating possible moisture pickup when the furnace is not in use for some time.

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SO far, this article has described the use of nitrogen gas, its effects, production, operation of the equipment and the type of furnaces most suitable for it to be used in. Following will be presented complete data of production charges, as collected for comparative purposes on several types of alloy steel rods, with gas reaction or equilibrium charts for each charge showing the reactions, if any, that have taken place during the entire heating and cooling cycle.

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Research on Surface Decarburization

MUCH splendid work has been done on research work in the study of decarburization. The books and data of these research metallurgists are of great help to designers and operators of furnaces and atmosphere equipment for the industries in the productive field. But, since most of these studies and investigations were carried out in laboratory type furnaces and with relatively small samples of steel, under conditions unlike those existing in a production plant, certain corrections to suit operating conditions must be applied in the consideration and solution of problems in the production annealing plant. Although, principally, they are based on and solved with the aid of research and experimental data, some of these differences in conditions may be listed as follows:—

1. **The variation in size and capacity of furnaces**
2. **The variation in types of steels being annealed**
3. **The variation of material sizes and charge weights**

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THESE conditions make uniformity of results more difficult to obtain, but they can be achieved by establishing standard practices, to be followed by all operators.

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The Dependent Variables of Decarburization

THE extent of decarburization, or the prevention of it, may be said to depend on the following matters:—

1. **The extent of the decarburizing effect of the protective atmosphere and the presence of any decarburizing constituent that may be contained therein**
2. **The temperature of the steel at which it is exposed to this atmosphere**
3. **The period or length of exposure at this temperature**
4. **The carbon content or type of steel**

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THESE conditions are termed the dependent variables of decarburization, for the reason that it is on all four matters that its prevention or cause depends. Change or variation of just one of the four, will change the result of decarburizing to that of non-decarburizing or vice versa. For a matter of illustration, let us use the following example:—

1. **Atmosphere is mildly decarburizing**
2. **Temperature of the steel exposed to it, is 1550°F.**
3. **Period of exposure is 5 hours**
4. **Carbon content of steel is 40%**

THE steel, under the above conditions was not decarburized, but if we changed No. 3, the time or period of exposiure to 20 hours, the steel becomes decarburized, or if we changed No. 4, the carbon content of the steel, to 100%, the steel again would become decarburized.

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Neutrality of Atmospheres

IN the terms of combustion, an atmosphere is considered neutral when it is burned with neither an excess nor deficiency of air, or one that is neither oxidizing nor reducing. Thus, if such an atmosphere is perfectly combusted, and the CO_2 is removed by absorbtion, as in nitrogen production of the type discussed here, with no hydrogen and carbon monoxide present and the water vapor removed, the balance in this case would be totally nitrogen (N_2).

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WHILE such an atmosphere can be considered neutral and not decarburizing, it will not prevent decarburization. Therefore, the term "neutral" should not be confused with an atmosphere neutral to steel of some known carbon content, and in balance with it, at annealing temperatures.

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FOR an atmosphere considered neutral in combustion terms, in order to prevent further decarburization, a further balance must be made, so that it may be in balance with the carbon content of the steel or in equilibrium with it at annealing temperatures.

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Carbon Equilibrium

THIS balance of equilibrium is obtained by operating the generator on the reducing side or with a deficiency of air, so that from 2.0% to 3.0% carbon monoxide is contained in the atmosphere; at this air-gas ratio, the products of combustion will also contain approximately the same amounts of hydrogen. This range of setting has been found to prevent additional decarburization on medium to high carbon steels and moder-

ately alloyed N.E. and S.A.E. types, containing chromium, nickel and molybdenum. Therefore, it is necessary for this atmosphere to contain 2.0% to 3.0% CO and H_2 of which the balance of 94 to 96 percent is N_2.

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Reduction of Impurities

IN the atmosphere at equilibrium, containing CO and H_2, it is the carbon molecule of the CO that supports the carbon in the steel or holds it at equilibrium. Without this content of CO, this Monogas atmosphere would not prevent decarburization on steels with which it is used. Therefore, this easy control of the CO content in the generating process is of great advantage. The H_2 cnstituent in the atmosphere is of no great help in preventing decarburization; but, it is required in applications of bright annealing, in that, at lower temperatures, the H_2 will carry greater amounts of H_2O in ratio, which is required in preventing oxidation.

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BOTH constituents CO and H_2, in the percentages contained, are mildly reducing. Their reducing properties may cause reactions with any impurities that may be on the surface of the steel, such as scale, moisture, drawing lubricants or rust.

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THESE reducing reactions cause the formation of CO_2 and H_2O. If these decarburizing constituents are formed in any great amounts, above that which will prevent decarburization, the ultimate results of prevention of decarburization will not be obtained.

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Ratios of Decarburization

ALTHOUGH the amounts permissible are rather small, we must not assume that no formation of CO_2 or H_2O can be tolerated in the reactions of the gas, either with each other or with the impurities. Neither is it, directly, the amount formed in the combination of reactions that determines whether the gas is decarburizing or non-decarburizing. The actual determining factor is the ratio of CO_2:CO in the gas surrounding the charge, under the inner cover. The CO in this ratio is not the CO content of the entering atmosphere, but the content of the atmosphere under the cover, to which the steel is exposed at some elevated temperature.

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THE percentages of CO_2 and CO may be determined by means of an ordinary Orsat, the sample of gas being taken from the gas discharge line out of the furnace base. This percentage ratio is referred to as the ratio of decarburization. The permissible ratio depends on the other three dependent variables, i.e., temperature of steel, period of exposure and the carbon content of the steel.

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FOR the common types of steels of 35 to 45 percent carbon, and the moderately alloyed types of the same carbon content, it was found that a gas with a CO_2 to CO ratio not greater than .17 was not decarburizing to the steel at spheroidizing temperatures, between 1400 to 1500°F. even at long periods of exposure. This concerns only decarburization that may be caused by excessive CO_2 formation, and not that which may also be caused by excessive H_2O content or moisture formation, which must always be taken into consideration.

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WITH gas reactions such that a CO_2:CO ratio not greater than .17 was produced, and the H_2O content corresponded at saturation to a dew point not higher than -8°C., at any time during the cycle, further decarburization was entirely prevented during the spheroidizing cycles of the above mentioned steels and at their temperatures. "Entirely prevented" means that, after cooling to a temperature of 1000°F., no further "decarb" was indicated on the steel than the amount existing when charged.

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Air Filtration

AS previously mentioned, the most suitable, if not the only furnace, in which nitrogen atmosphere can be used with best results, is the bell type, oil sealed furnace, with an alloy inner cover to seal in the charge. In this furnace, the base, of course, is gas tight and has a seal of the liquid type (oil). Dry sand seals may also be used with success, but greater rates of atmosphere gas input are required, to make up for leaks and seepage due to the porosity of the material. The sands used must be free of or low in iron and other oxides, so as to keep the reducing reactions of the atmosphere at a minimum.

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THE use of radiant tube fired furnaces also affords some protective advantage. In a radiant tube furnace, the space between the furnace and inner cover is comparatively free of the strongly decarburizing gases CO_2 and H_2O, as compared to a direct fired furnace. In this manner, the material will have some protection, should an inner cover spring leaks by cracking and infiltration of these decarburizing gases take place by diffusion over long periods of time, even though the usual internal pressures of 0.5″ to 1.0″ W.C. above atmospheric are maintained. Infiltered air cannot be determined as oxygen by Orsat analysis in the discharge gases from the base, as it very rapidly combines with the H_2 and CO of the nitrogen atmosphere at annealing furnace temperatures. The chemical reactions of this are shown by the following equations:

$$2H_2 + O_2 \rightleftarrows H_2O$$

$$2\,CO + O_2 \rightleftarrows 2CO_2$$

Note that in both cases, the reactions formed a decarburizing gas, illustrating why air infiltration has to be avoided.

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THERE have been instances, where pulling a hot bell off the inner cover too rapidly caused a sudden contraction of the atmosphere which was so great that the rate of flow was not sufficient enough to displace the rate of contraction; instead of a 1″ positive pressure, a negative or vacuum of 1″ was created. Thus, air was drawn into the atmosphere dis-

charge pipe, and caused decarburization.

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Test Charges

A SUMMARY is given of complete data on five charges of spheroidized anneal of two kinds of common alloy steel rod coils, one hot rolled, the other cold drawn, under various conditions. While these were full size loads, run as production orders, the primary objective was the study and analysis of decarburization and gas reactions, and their effect upon the ultimate decarburization result on the steel. (See Data Table, Fig. 3)

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FOR each charge, a gas equilibrium chart has been made. These charts show the percentages of CO and the dew points of the exit gas throughout the complete cycle; also, the percentage of CO_2 formation, if any, caused by reactions and the period of time involved. They also show the temperature of the steel. For comparison, the cycle as indicated on the temperature chart may be compared with the proposed treatment cycle for the charges as given in the Data Table, Fig. 3.

✦ ✦ ✦

THE graphical values on these charts may be compared with the data under column headed "Discharge Atmosphere Analysis During Cycle," where they are given in numerical values for each phase of the complete cycle. A brief summary of results and explanation of reactions is given for each charge.

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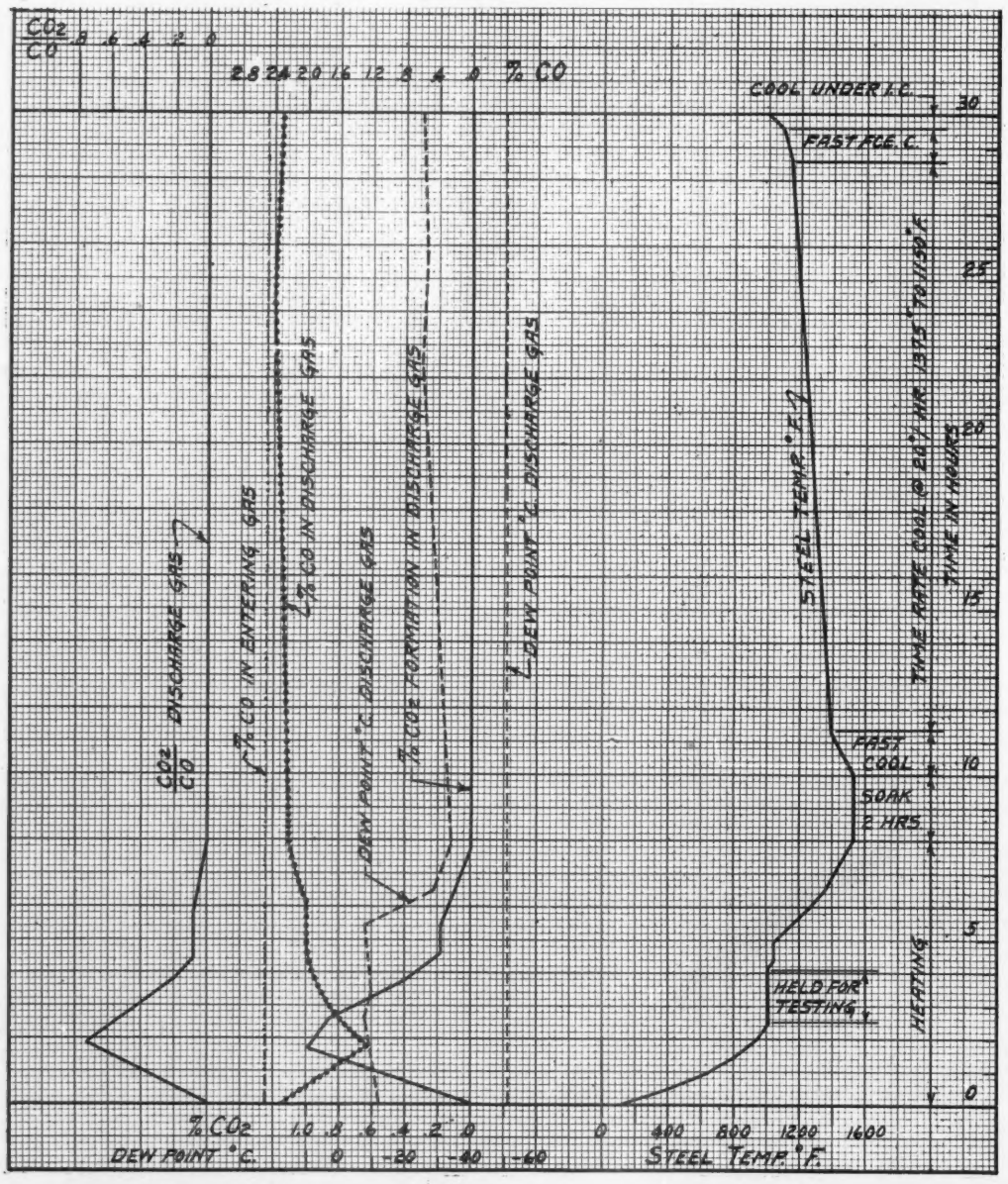

Fig. 4. Gas Equilibrium Chart Charge No. 1. N.E. 8630. 1525° F.

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Charge #1

THIS was a full furnace capacity load of N E 8630 steel, (see Fig. 3). The inner cover was purged for an hour; after this purge, the dew point of the discharge gas was -12°C. The dew point of the atmosphere entering the furnace was -51°C., which indicates that the H_2O content of the gas after discharge was considerably higher than when it entered. This was due to air under the inner cover caused by incomplete purging. The moisture in the air was picked up by the dry gas, increasing the dew point to -12°C. Part of this increase may have been due to the moisture contained on the surface of the coils after they had been pickled and washed.

BY studying the gas equilibrium chart for this charge, one can see that the CO content of the gas reacted after the application of heat, which would accelerate such a reaction. In atmospheres of complex mixtures, it is possible for the constituents to interact or react with each other and with the carbon of the steel. It is also possible for the CO to react with any impurities, that may be present on the surface of the steel, as CO is a reducing agent.

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THE reaction of CO resulted in the formation of 1% CO_2. The peak of this reaction took place after 1 hour and 45 minutes, at which time, the steel was at 900°F. The CO_2:CO ratio of the gas at this time, was, as shown on the chart,

$$\frac{CO_2}{CO} = \frac{1.0}{1.3} = .77$$

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AN atmosphere of such ratio is considered strongly decarburizing at ordinary annealing temperatures for steel of this carbon content, but we should remember that the steel temperature at this point was only 900°F. and not 1525°F., at which temperature, the charge is being spheroidized. At the lower temperature, the decarburizing effects on the steel would be very little even on steel of considerably higher carbon content.

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AFTER this peak, a reversal of the reaction began to take place, in the direction of approach to neutral, as the temperature increased. At the end of 5¾ hours, at which time the steel temperature was 1230°F., the reactions were completed, and the gas reached the state of equilibrium and became neutral in contact with the steel at this temperature. From this point to the completion of the charge cycle, the atmosphere was neutral, and no further reactions were indicated, with the CO in the discharge gas approaching the CO content in the entering gas to a point when it was very nearly in equilibrium with the carbon of the steel.

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Metallurgical Results

AS the metallurgical results at the bottom of the data table indicate, there was no further decarburization during this spheroidizing cycle. Some of the coils even indicated less "decarb" after annealing than before. On some coils, the nature of the decarburization, aside from the affected depth on the periphery of the surface, were improved. Where the existing decarb before annealing was of a heavy partial depth, after annealing, the material came out with just a light partial depth. In such cases, the carbon content at the surface, if analyzed chemically, would be slightly higher than before annealing and more nearly equal to the core section. Where decarb specifications are based on permissible percentage of loss in carbon content by chemical analysis, results of this kind are of a great advantage.

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Photomicrograph of Coil No. 5

FIGURE No. 5 shows photomicrographs of actual test pieces of coil No. 5 of charge No. 1, before and after annealing. (a) is in the hot rolled condition, pickled, and washed; (b) is a test piece from the same coil, cut from the same end after annealing.

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FIGURE No. 5 shows (a) the decarburization depth existing in the hot rolled state, which is .004″ medium partial, and (b) the decarburization depth after annealing, which is .004″ light partial.

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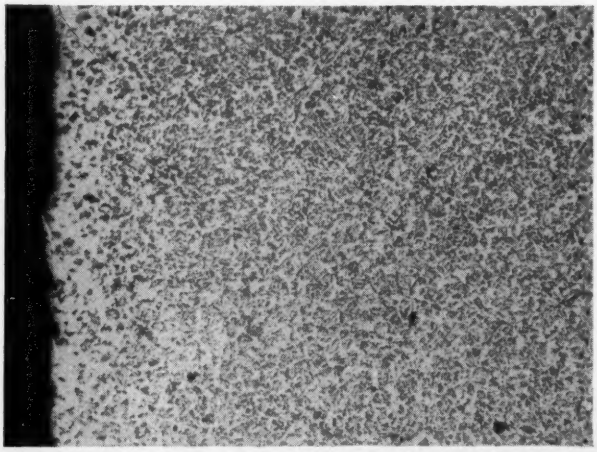
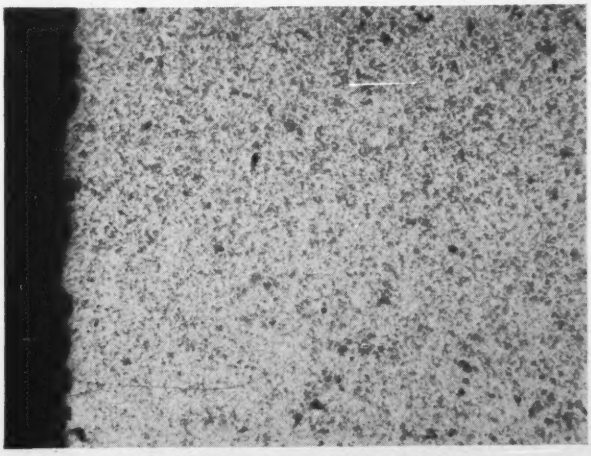
BY comparing these two micros, it is very plainly seen that the decarburization in the hot rolled condition is far more distinctive. It may be asked, why there is so much less indication of decarburization after annealing. The answer to this is that the carbon in the



(a) Photomicrograph of test piece. Showing surface decarb. as hot rolled and before annealing. Coil No. 5 Charge No. 1. Existing decarb.=.004″ Medium Partial. X 100. ✦ ✦ ✦ ✦ ✦



(b) Photomicrograph of test piece. Showing surface decarb. after annealing. Coil No. 5 Charge No. 1. Decarb.=.004″ Light Partial. X 100. ✦

Fig 5. Photomicrographs showing decarb. before and after annealing. ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦

steel redistributed itself within the boundaries of the rod for completely equal arrangement, since it could not break down the equilibrium and leave the steel.

✦ ✦ ✦

IF the method of testing for the amount of decarburization were chemical analysis, with the carbon loss in percentage of carbon content in the surface turnings of the test piece at .008″ surface depth, the results would probably indicate that the carbon content of the test piece after annealing was higher than that of the piece before annealing for the same depth of turnings.

✦ ✦ ✦

COMPARATIVE data on this method of analysis was obtained on test pieces which were placed in some of the following charges for this purpose. The explanation of this is that carbon from the core, or inner section of the steel, migrates or diffuses outward into the existing decarburized surface, where it is much lower in carbon content. Such a condition of outward diffusion would tend to approach a point nearer to carbon equalization and indicate a less distinctive demarcation gradient in carbon loss between the surface and inner core section.

✦ ✦ ✦

IN studying the gas equilibrium chart for Charge #1 at the point where the gas approached equilibrium at 8 hours, it can be observed that the CO content of discharged atmosphere is slightly less than the CO content of the entering gas. This difference is only about .1 to .2 of one percent less, indicating that the gas is at equilibrium and tends to approach the point of reaction.

✦ ✦ ✦

IT is indicated from the entering and discharge gas analysis, that the possible reaction which the CO has the tendency to approach is to break down to form free C and CO_2. Theoretically, the atmosphere is not exactly in equilibrium, as the difference in CO indicates, but it is near enough, as the metallurgical results on Fig. #3 show that decarburization was prevented.

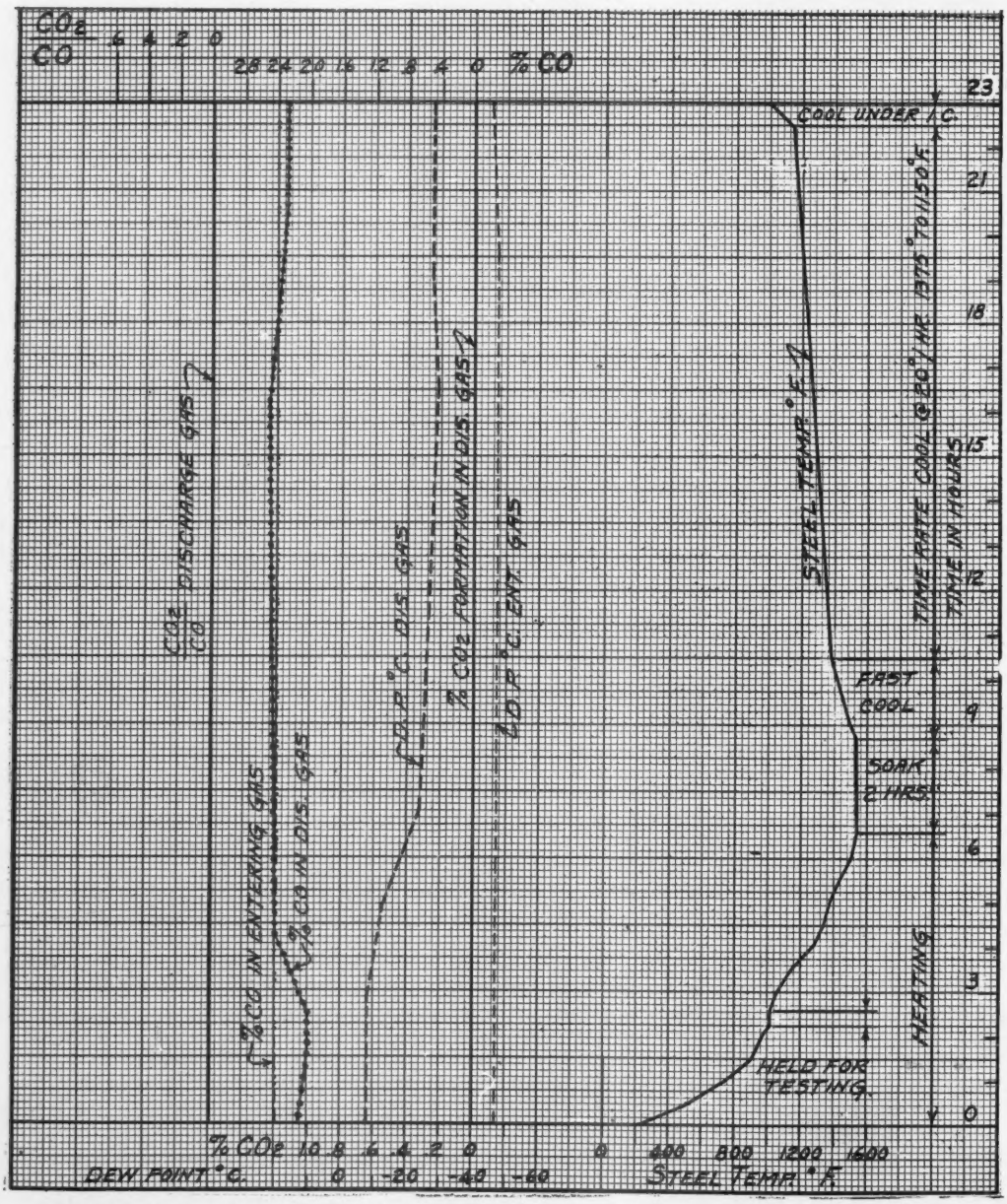


Fig. 6. Gas Equilibrium Chart Charge No. 2. N.E. 8630. 1525° F.

Complex Gas Mixtures

IT is difficult, if not impossible, to determine the exact reactions taking place in atmospheres of this nature which contain several reactive constituents in contact with steel at variable temperatures. In complex mixtures, it is possible that the reacting constituents act partially or entirely, and more than one reaction may take place simultaneously. The fact that the reactive constituents of the atmosphere may react in the forward form, and possibly dissociate in the reversed form, adds considerably to the complexity of exact determination. The best way to illustrate the reactions is through individual chemical equations. However, approximate possible reactions can be formulated from the values and reactions indicated on the gas equilibrium charts for the various charges throughout the entire annealing cycle.

✦ ✦ ✦

THE presence of oxide bearing impurities on the charges is most certain to create reducing reactions with the reducing constituents CO and H_2. Such reactions are completed in a short period of time, if not contained in great proportions, as indicated on the equilibrium chart.

✦ ✦ ✦

WHILE such atmosphere should be low in H_2O content, and very dry, it is possible that excessively dry gas is not ideal for all temperatures.

✦ ✦ ✦

AS the proper CO_2:CO ratios must be maintained to prevent decarburization at the various temperatures, it is also necessary to maintain the proper H_2O:H_2 ratios at various temperatures, so that this combination be kept neutral or reducing and not oxidizing. The proper moisture or H_2O content has much to do with the H_2O water gas reactions which are decarburizing.

✦ ✦ ✦

Charge #2

THIS charge was a full load of NE 8630 rod coils. The gas equilibrium chart, Fig. 6, indicates that no reaction which would result in CO_2 formation took place.

✦ ✦ ✦

HOWEVER, there is a reactive indication of CO and H_2O. On

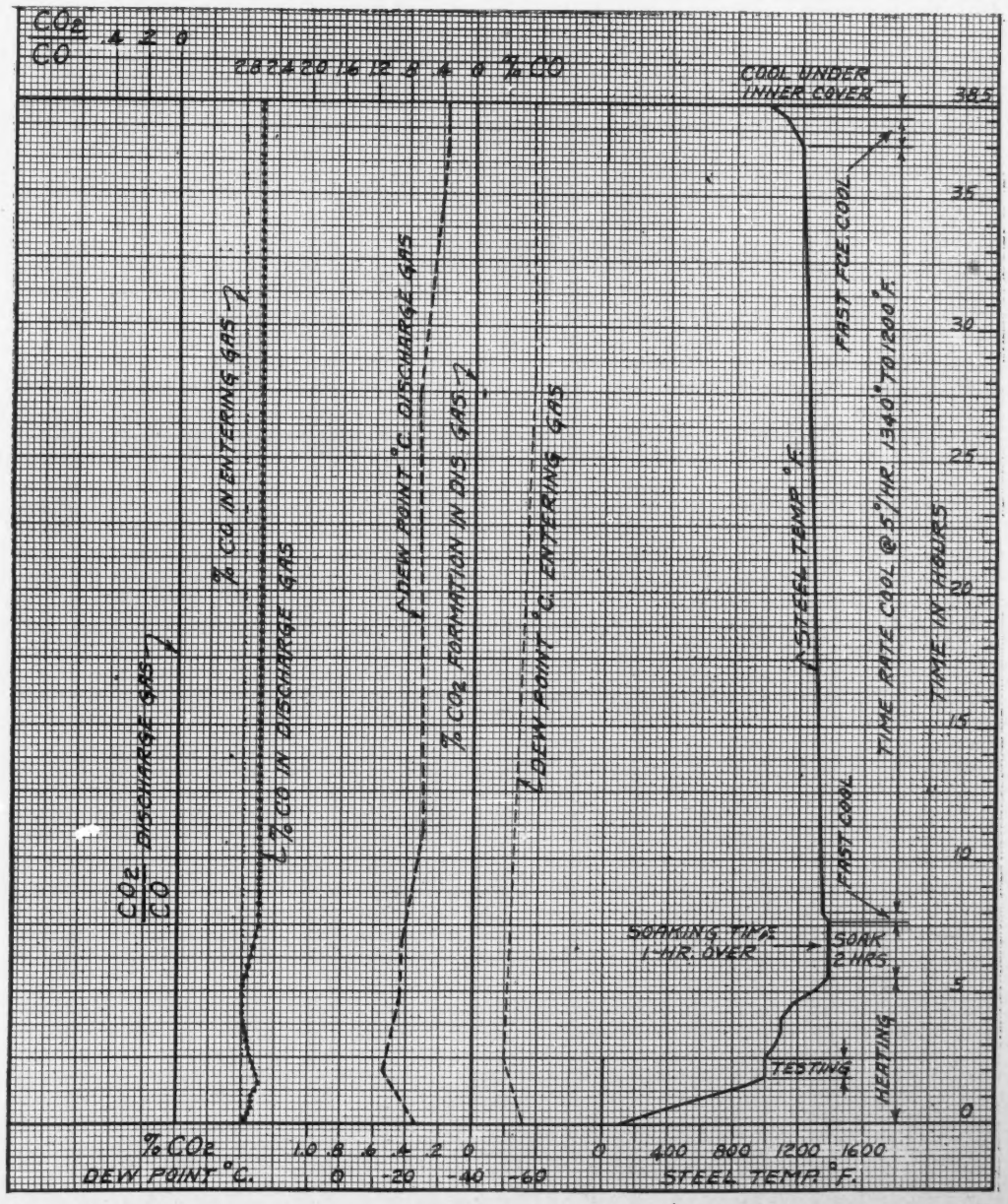


Fig. 7. Gas Equilibrium Chart Charge No. 3. S.A.E. 3135. 1390° F.

this charge, the CO reached the point of equilibrium at the end of four hours, at steel temperature of 1250°F. At this point, the CO content of the atmosphere leaving the furnace was just about the same as that entering. This remained the same up to the 16½ hour mark, and to a steel temperature of 1250°F., on the cooling cycle.

✦ ✦ ✦

LET us compare the dew points of the gas leaving and entering on this charge, with that of charge #1. On Charge No. 1, the dew point of the gas entering was slightly higher than that of #2; the gas leaving the furnace was -24°C for #2 and -34°C for #1. This indicates that the H_2O was in equilibrium with the gas. It might be noted that on #1, the dew point of the discharge gas dropped, and that on #2 it rose, or increased, while the CO also increased to approach that of the entering gas, indicating that a small amount of water vapor does have some effect in stabilization of gas equilibrium. On both charges, a CO drop in the discharge gas took place at 1250°F. steel temperature.

✦ ✦ ✦

ON this charge, test pieces from only three coils were taken for decarburization examination. These did not show any further decarburization after annealing; in fact, there was even less than before annealing.

✦ ✦ ✦

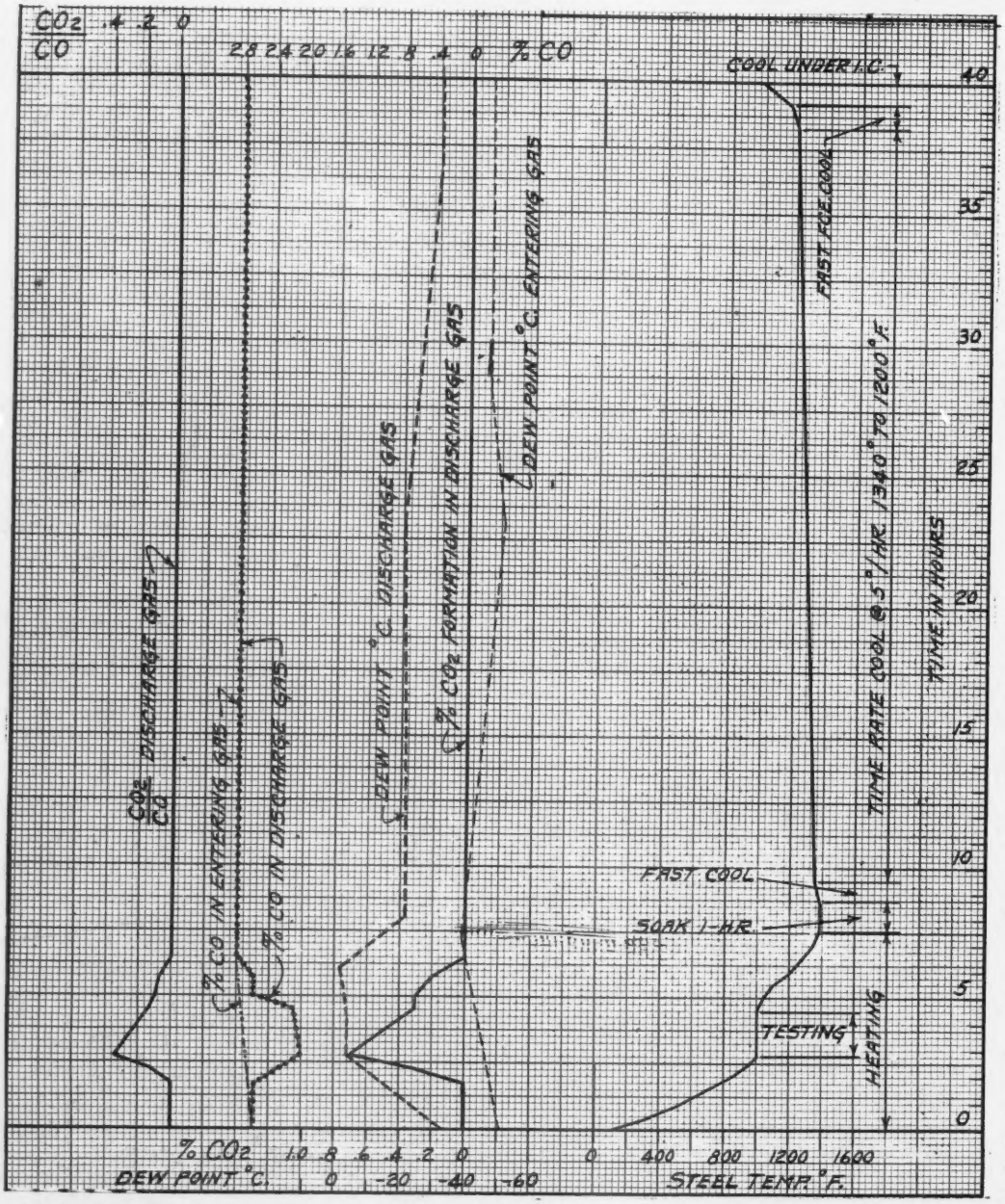


Fig. 8. Gas Equilibrium Chart Charge No. 4. S.A.E. 3135. 1390° F.

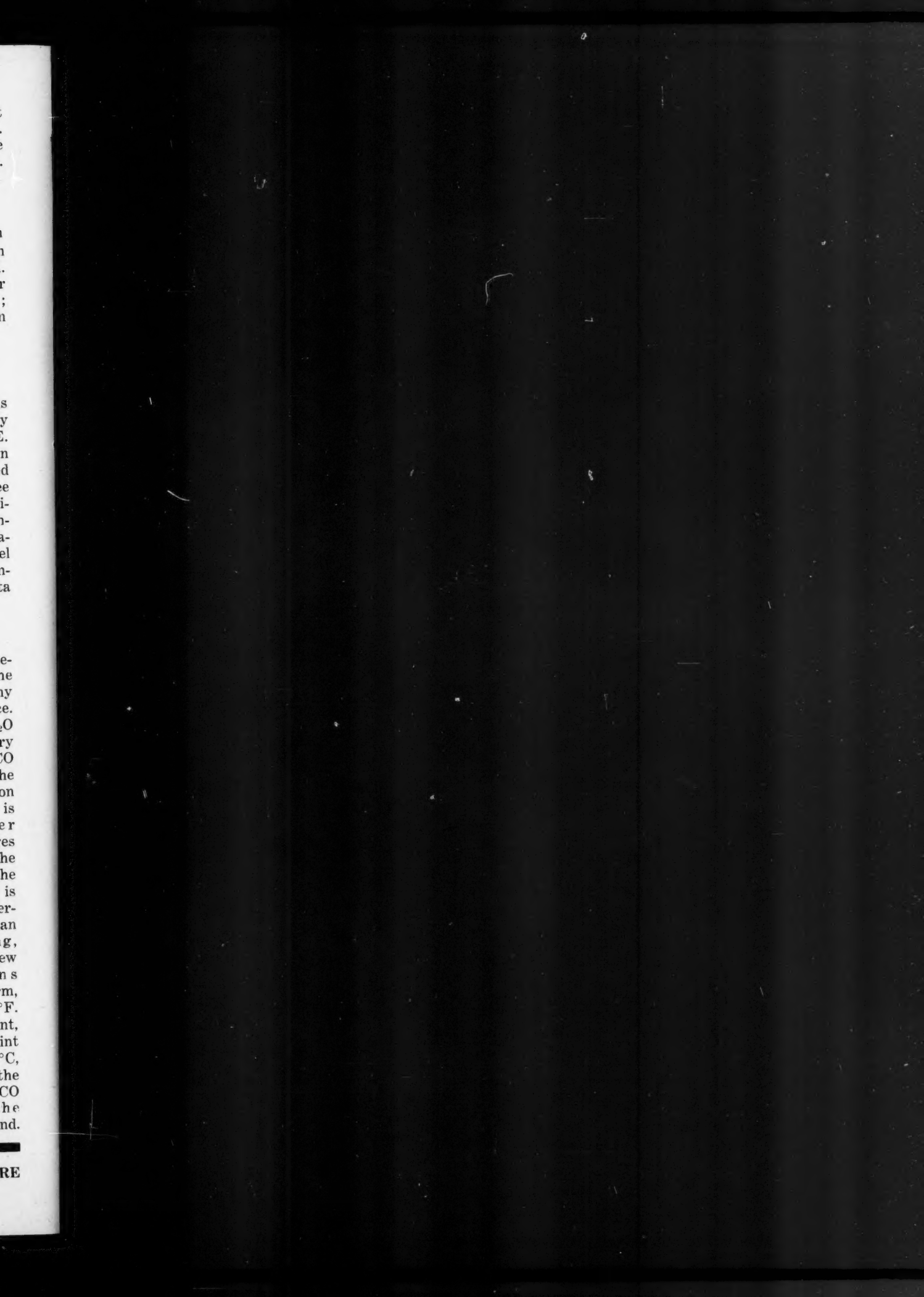
Charge #3

THIS charge is one of only six coils of S.A.E. 3135 cold drawn rod coils, pickled and washed free of drawing lubricants. The annealing temperature of this steel is 1390°F, as indicated on Data Table Fig. #3.

✦ ✦ ✦

NO reaction resulting in the formation of any CO_2 took place. The CO and H_2O reacted very lightly; the CO content of the entering gas on this charge is slightly higher than on charges #1 and #2. The CO content of the discharge gas is about .2 of a percent lower than that entering, while the dew point remains fairly uniform, -25°C at 1225°F. From this point, the dew point dropped to -31°C, at the end of the cycle, but the CO remained the same to the end.

✦ ✦ ✦ ✦ ✦ ✦



FOR CHARGE - CYCLE - N

IN 48" DIA. X 84

CHARGE	CYCLE	BASE & FCE. NO.	GAS
TYPE OF STEEL NO. OF COILS SIZE DIA. & WGHT. CONDITION	TREATMENT TEMPERATURE DEGREES F.	TYPE SEAL USED ALLOY INNER COVER-IF USED	NAT. AIR F GAS F AIR-G
CHARGE NO. 1 NE 8630 18 COILS 15/32" DIA. RD. HOT ROLLED 4680 LBS. PICKLED & WASHED	HEAT TO 1525°F. SOAK 2 HOURS FCE. COOL TO 1375° COOL TO 1150°@20° PER HR. FCE. COOL TO 1100°-LIFT BELL LIFT IN. COV. @1000°	BASE No. 1 FCE-D DOUBLE SEAL OIL SEAL INSIDE & CIRCULATING WATER OUT SIDE - ALLOY INNER COVER USED USED OIL IN SEAL	AIR = GAS = AIR / RATI
CHARGE NO. 2 NE 8630 18 COILS 21/32" DIA. RD. HOT ROLLED 4680 LBS. PICKLED & WASHED	HEAT TO 1525°F. SOAK 2 HRS. FCE. COOL TO 1375° COOL TO 1150°@20° PER HR. FCE. COOL TO 1150° LIFT BELL LIFT I.C. @ 1000°	BASE No 1 FCE-D DOUBLE SEAL OIL SEAL INSIDE & CIRCULATING WATER OUTSIDE - ALLOY INNER COVER USED NEW SEAL OIL USED	AIR = GAS AIR/ RATI
CHARGE NO 3 S.A.E. 3135 6 COILS .455/.461" DIA. RD. COLD DRAWN 1220 LBS. PICKLED & WASHED	HEAT TO 1390°F. SOAK 1 HOUR; FCE. COOL TO 1340°; COOL TO 1200°@5°PER HR. FCE. COOL TO 1050°; LIFT BELL LIFT I.C. @1000°	BASE No. 1 FCE.-D DOUBLE SEAL OIL INSIDE & CIR- CULATED WATER OUTSIDE - ALLOY INNER COVER USED USED OIL IN SEAL	AIR = GAS = AIR / RATI
CHARGE NO 4 S.A.E. 3135 20 COILS .455/.461" DIA. RD. COLD DRAWN	HEAT TO 1390°F. SOAK 1 HOUR; FCE. COOL TO 1340°; COOL TO 1200°@5°PER HR. FCE. COOL TO 1050°	BASE No. 1 FCE.-D DOUBLE SEAL OIL INSIDE & CIR- CULATED WATER OUTSIDE - ALLOY	AIR = GAS = AIR / RATI

DATA TABLE

CLE - NITROGEN GAS ATMOSPHERE & DECARBURIZATION
DIA. X 84" HIGH - RADIANT TUBE FIRED - CIRCULAR TYPE FURNACE - V

NO.	GAS COMBUSTOR DATA		N_2 ANALYSIS	NITROGEN FLOW A
D	NAT. GAS FUEL AIR FLOW C.F.H. GAS FLOW C.F.H. AIR-GAS RATIO	GAS ANALYSIS OUT OF COMB- USTOR - % BY VOLUME	GAS ANALYSIS % BY VOL. AFTER CO_2 REMOVAL & AFTER ALUMINA DRYER	HIGH FLOW-PURGING NO. OF ORIFICE PLATES SIZE OF HOLE DIA. PRESS. " W.C. - FLOW C.F.H.
D & ER D	AIR = 1850 GAS = 190 AIR / GAS RATIO = 9.5:1	CO_2 = 10.3 O_2 = 0.0 CO = 2.3 H_2 = 2.3 EST. N_2 = 85.1 BAL. D.P. = COOLED TO + 95°F.	CO_2 = 0.0 O_2 = 0.0 CO = 2.5 H_2 = 2.5 EST. N_2 = 95.0 BAL. D.P. = -51°C. H_2O = .003 %	2-ORIFICE PLATES 1-11/32" DIA. 1-1/4" DIA. HEADER PR. = 6.4" INLET PR. = 3.2" INNER COV. PR. = 1.0" DISCHARGE = 1 1/4" I.P.S. FLOW = 255 C.F.H.
& ER D	AIR = 1900 GAS = 195 AIR/GAS RATIO = 9.2:1	CO_2 = 9.9 O_2 = 0.0 CO = 2.2 H_2 = 2.2 EST. N_2 = 85.7 BAL. D.P. = COOLED TO + 96°F.	CO_2 = 0.0 O_2 = 0.0 CO = 2.4 H_2 = 2.4 EST. N_2 = 95.4 BAL. D.P. = -47°C. H_2O = .005 %	2-ORIFICE PLATES 1-11/32" DIA. 1-1/4" DIA. HEADER PR. = 6.3" INLET PR. = 3.1" IN. COV. PR. = 1.0 DISCHARGE = 1 1/4" I.P.S. FLOW = 255 C.F.H.
D ED	AIR = 1900 GAS = 200 AIR / GAS RATIO = 9.5:1	CO_2 = 9.6 O_2 = 0.0 CO = 2.6 H_2 = 2.6 EST. N_2 = 85.2 BAL. D.P. = COOLED TO + 90°F.	CO_2 = 0.0 O_2 = 0.0 CO = 2.8 H_2 = 2.8 EST. N_2 = 94.4 BAL. D.P. = -56°C. H_2O = .002 %	2-ORIFICE PLATES 1-11/32" DIA. 1-1/4" DIA. HEADER PR. = 6.3" INLET PR. = 3.1" IN. COV. PR = 1.5" DISCHARGE = 1 1/4" I.P.S. FLOW = 255 C.F.H.
	AIR = 1900 GAS = 200 AIR / GAS RATIO = 9.5:1	CO_2 = 9.4 O_2 = 0.0 CO = 2.4 H_2 = 2.4 EST. N_2 = 85.8 BAL.	CO_2 = 0.0 O_2 = 0.0 CO = 2.6 H_2 = 2.6 EST. N_2 = 94.8 BAL.	2-ORIFICE PLATES 1-11/32" DIA. 1-1/4" DIA. HEADER PR. = 6.4" INLET PR. = 3.1" IN. COV. PR. = 0.9"

A TABLE ⊃.

ARBURIZATION ON ALLOY STEEL ROD COIL SPHERO
TYPE FURNACE - WITH ALLOY INNER COVER & SEALED BASE

TROGEN FLOW AND PRESSURES		DISCHARGE ATMOSI	
GH FLOW - PURGING	LOW FLOW - HEATING	ANALYSIS % BY VOLUM ENTERING AND LEAVI	
OF ORIFICE PLATES E OF HOLE DIA. ESS. " W.C. - FLOW C.F.H.	NO. OF ORIFICE PLATES SIZE OF HOLE DIA. PRESS. "W.C. - FLOW C.F.H.	AT END OF PURGE	AT 10 STEEL
ORIFICE PLATES 11/32" DIA. 1-1/4" DIA. ADER PR. = 6.4" ET PR. = 3.2" ER COV. PR. = 1.0" CHARGE = 1 1/4" I.P.S. OW = 255 C.F.H.	1 - ORIFICE PLATE 1/4" DIA. HOLE HEADER PR. = 6.7" INLET PR. = 1.1" INNER COV. PR. = 0.8" DISCHARGE = 3/8" I.P.S. FLOW = 125 C.F.H.	CO_2 OUT = 0.0 CO OUT = 2.3 CO_2 : CO = 0.0 CO IN = 2.5 D.P. IN = -51°C. D.P. OUT = -12°C. H_2O OUT = .219%	CO_2 OU CO OUT CO_2 : CO CO IN D.P. IN D.P. OUT H_2O OUT
ORIFICE PLATES 11/32" DIA. 1-1/4" DIA. ADER PR. = 6.3" ET PR. = 3.1" COV. PR. = 1.0 SCHARGE = 1 1/4" I.P.S. OW = 255 C.F.H.	1 - ORIFICE PLATE 1/4" DIA. HOLE HEADER PR. = 6.4" INLET PR = 1.4" IN. COV. PR. = 1.0" DISCHARGE = 3/8" I.P.S. FLOW = 120 C.F.H.	CO_2 OUT = 0.0 CO OUT = 2.1 CO_2 : CO = 0.0 CO IN = 2.4 D.P. IN = -47°C. D.P. OUT = -8°C. H_2O OUT = .314%	CO_2 OUT CO OUT CO_2 : CO CO IN D.P. IN D.P. OUT H_2O OUT
ORIFICE PLATES 11/32" DIA. 1-1/4" DIA. ADER PR. = 6.3" ET PR. = 3.1" COV. PR = 1.5" SCHARGE = 1 1/4" I.P.S. OW = 255 C.F.H.	1 - ORIFICE PLATE 1/4" DIA. HOLE HEADER PR. = 6.7" INLET PR. = 1.1" IN. COV. PR. = 0.8" DISCHARGE = 3/8" I.P.S. FLOW = 125 C.F.H.	CO_2 OUT = 0.0 CO OUT = 2.6 CO_2 : CO = 0.0 CO IN = 2.8 D.P. IN = -56°C. D.P. OUT = -23°C. H_2O OUT = .075%	CO_2 OUT CO OUT CO_2 : CO CO IN D.P. IN = D.P. OUT H_2O OUT
ORIFICE PLATES 11/32" DIA. 1-1/4" DIA. ADER PR. = 6.4" ET PR. = 3.1" COV. PR. = 0.9"	1 - ORIFICE PLATE 1/4" DIA. HOLE HEADER PR. = 6.7" INLET PR. = 1.1' IN. COV. PR. = 0.7"	CO_2 OUT = 0.0 CO OUT = 2.6 CO_2 : CO = 0.0 CO IN = 2.6 D.P. IN = -51°C.	CO_2 OUT CO OUT CO_2 : CO CO IN D.P. IN =

PHEROIDIZING ANNEAL
D BASE

J.L. KOZMA
JAN. 15, 1944

ATMOSPHERE ANALYSIS DURING CYCLE			REMARKS
BY VOLUME AND DEW POINT OF ATMOSPHERE AND LEAVING FURNACE - CO_2:CO RATIO			HOURS TIME HELD @ 1000°F. STEEL TEMP. FOR TESTING & COMP. TO SAFE REACTIONS
AT 1000° STEEL TEMP.	AT SOAKING CYCLE	AT END OF COOLING CYCLE	
CO_2 OUT = 0.9 CO OUT = 1.6 CO_2:CO = .56 CO IN = 2.5 D.P. IN = -51°C. D.P. OUT = -8°C. H_2O OUT = .314%	CO_2 OUT = 0.0 CO OUT = 2.2 CO_2:CO = 0.0 CO IN = 2.5 D.P. IN = -50°C. D.P. OUT = -34°C. H_2O OUT = .023%	CO_2 OUT = 0.0 CO OUT = 2.3 CO_2:CO = 0.0 CO IN = 2.5 D.P. IN = -50°C. D.P. OUT = -26°C. H_2O OUT = .057%	TESTING = 0.5 GAS REACTED: YES TO REACH SAFE CONDITION = 1.5 NEUTRAL COND. = 7.5 COMP CYCLE = 30.0
CO_2 OUT = 0.0 CO OUT = 2.0 CO_2:CO = 0.0 CO IN = 2.4 D.P. IN = -47°C. D.P. OUT = -8°C H_2O OUT = .314%	CO_2 OUT = 0.0 CO OUT = 2.4 CO_2:CO = 0.0 CO IN = 2.4 D.P. IN = -47°C. D.P. OUT = -24°C. H_2O OUT = .069%	CO_2 OUT = 0.0 CO OUT = 2.3 CO_2:CO = 0.0 CO IN = 2.4 D.P. IN = -45°C. D.P. OUT = -27°C. H_2O OUT = .052%	TESTING = 0.5 GAS REACTED: NO TO REACH SAFE CONDITION = 0.0 NEUTRAL COND. = 0.0 COMP. CYCLE = 23.0
CO_2 OUT = 0.0 CO OUT = 2.7 CO_2:CO = 0.0 CO IN = 2.8 D.P. IN = -50°C. D.P. OUT = -13°C. H_2O OUT = .209%	CO_2 OUT = 0.0 CO OUT = 2.8 CO_2:CO = 0.0 CO IN = 2.8 D.P. IN = -50°C. D.P. OUT = -19°C. H_2O OUT = .113%	CO_2 OUT = 0.0 CO OUT = 2.6 CO_2:CO = 0.0 CO IN = 2.8 D.P. IN = -58°C. D.P. OUT = -31°C. H_2O OUT = .033%	TESTING = 0.75 GAS REACTED: NO TO REACH SAFE CONDITION = 0.0 NEUTRAL COND. = 0.0 COMP. CYCLE = 38.5
CO_2 OUT = 0.7 CO OUT = 2.0 CO_2:CO = .35 CO IN = 2.6 D.P. IN = -50°C.	CO_2 OUT = 0.0 CO OUT = 2.8 CO_2:CO = 0.0 CO IN = 2.8 D.P. IN = -39°C.	CO_2 OUT = 0.0 CO OUT = 2.8 CO_2:CO = 0.0 CO IN = 2.8 D.P. IN = -46°C.	TESTING = 0.5 GAS REACTED: YES TO REACH SAFE CONDITION = 1.75 NEUTRAL COND. = 4.75

CHARGE NO 4 S.A.E. 3135 20 COILS .455/.461" DIA. RD. COLD DRAWN 5100 LBS. PICKLED & WASHED	HEAT TO 1390° F. SOAK 1 HOUR; FCE. COOL TO 1340°; COOL TO 1200° @ 5° PER HR. FCE. COOL TO 1050° LIFT BELL, LIFT INNER COVER @ 1000°	BASE No. 1 FCE.-D DOUBLE SEAL OIL INSIDE & CIR- CULATED WATER OUTSIDE - ALLOY INNER COVER USED USED OIL IN SEAL	AIR GAS AIR / RATI
CHARGE NO. 5 S.A.E. 3135 21 COILS .455/.461" DIA. RD. COLD DRAWN 5420 LBS. PICKLED & WASHED	HEAT TO 1390° F. SOAK 1 HOUR; FCE. COOL TO 1340° COOL TO 1200° @ 5° PER HR; FCE. COOL TO 1000°; LIFT BELL @ 1000°	BASE No. 2 FCE.-A DOUBLE SEAL USED OIL IN BOTH SEALS - SEALED TYPE BURNER TUBES ON BELL NO INNER COV. USED	AIR GAS AIR / RATI

CHARGE No. 1

COIL NO.	DECARBURIZATION		HARDNESS Δ
	BEFORE ANNEAL	AFTER ANNEAL	
*1	.002/.006 H.P.	.004/.006 M.P.	80
2	.003 M.P.	.003 M.P.	80
3	.003 M.P.	.004/.002 V.H.P.	79/80
4	.005/.003 M.P.	.002 M.P.	78
5	.004 M.P.	.004 L.P.	81/82
6	.003 M.P.	.005 L.P.	80/81
7	.002 L.P.	.003 L.P.	80/81
8	.002/.006 H.P.	.006 L.P.	79.5/80
9	.004 L.P.	.004 L.P.	78/79
10	.006/.004 H.P.	.004 L.P.	77/79
11	.004 M.P.	.004 M.P.	81
12	.006/.002 V.H.P.	.006 M.P.	82/82.5
13	.003 H.P.	.006/.002 H.P.	84
14	.005/.003 H.P.	.006 M.P.	80/81
15	.003 M.P.	.003 M.P.	80.5/82
16	.008/.004 V.H.P.	.006 M.P.	78/80
17	.004 M.P.	.006 M.P.	79/80
18	.004/.008 M.P.	.002/.006 M.P.	82

CHARGE

COIL NO.	DECARBURIZA	
	BEFORE ANNEAL	AFT
*1	.004/.008 M.P.	.00
9	.004 H.P.	.00
18	NIL/.004 H.P.	NI

AIR = 1900 GAS = 200 AIR / GAS RATIO = 9.5:1	CO_2 = 9.4 O_2 = 0.0 CO = 2.4 H_2 = 2.4 EST. N_2 = 85.8 BAL. D.P. = COOLED TO + 92°F.	CO_2 = 0.0 O_2 = 0.0 CO = 2.6 H_2 = 2.6 EST. N_2 = 94.8 BAL. D.P. = -51°C. H_2O = .003%	2-ORIFICE PLATES 1-11/32" DIA. 1-1/4" DIA. HEADER PR. = 6.4" INLET PR. = 3.1" IN. COV. PR. = 0.9" DISCHARGE = 1 1/4" I.P.S. FLOW = 265 C.F.H.
AIR = 1850 GAS = 190 AIR / GAS RATIO = 9.7:1	CO_2 = 10.3 O_2 = 0.0 CO = 2.4 H_2 = 2.4 EST. N_2 = 84.9 BAL. D.P. = COOLED TO + 89°F.	CO_2 = 0.0 O_2 = 0.0 CO = 2.6 H_2 = 2.6 EST. N_2 = 94.8 BAL. D.P. = -51°C. H_2O = .003%	2-ORIFICE PLATES 1-11/32" DIA. 1-1/4" DIA. HEADER PR. = 6.4" INLET PR. = 1.7" FCE. BELL PR. = 0.35" DISCHARGE = 1 1/4" I.P.S. FLOW = 315 C.F.H.

METALLURGICAL RESULT

CHARGE NO. 2			CHARGE NO. 3				
DECARBURIZATION		HARD-NESS Δ	COIL NO.	DECARBURIZATION		HARD-NESS Δ	COIL NO.
NEAL	AFTER ANNEAL			BEFORE ANNEAL	AFTER ANNEAL		
M.P.	.004/.006 L.P.	85/86	*1	.004 L.P.	.002/.004 L.P.	92/93	*1
	.002/.003 H.P.	85/86	2	.004/.002 H.P.	.004 L.P.	93/94	2
H.P.	NIL/.002 L.P.	83/84	3	.004 M.P.	.004 L.P.	89/90	3
			4	.006/.004 M.P.	.002 L.P.	85/86	4
			5	.003 M.P.	.002 L.P.	84/85	5
			6	.004 M.P.	.004 L.P.	84/85	6
							7
							8
							9
							10
							11
							12
							13
							14
							15
							16
							17
							18
							19
							20

E PLATES . 1-1/4" DIA. PR. = 6.4" . = 3.1" . = 0.9" GE = 1 1/4" I.P.S. 265 C.F.H.	1-ORIFICE PLATE 1/4" DIA. HOLE HEADER PR. = 6.7" INLET PR. = 1.1' IN. COV. PR. = 0.7" DISCHARGE = 3/8" I.P.S. FLOW = 125 C.F.H.	CO2 OUT = 0.0 CO OUT = 2.6 CO2 : CO = 0.0 CO IN = 2.6 D.P. IN = -51°C. D.P. OUT = -33°C. H2O OUT = .026%	CO2 OUT = CO OUT = CO2 : CO = CO IN = D.P. IN = - D.P. OUT = - H2O OUT = .
E PLATES . 1-1/4" DIA. PR. = 6.4" . = 1.7" PR. = 0.35" GE = 1 1/4" I.P.S. 315 C.F.H.	2-ORIFICE PLATES 1-11/32" DIA. 1-1/4" DIA. HEADER PR. = 6.3" INLET PR. = 1.9" FCE. BELL PR. = 0.5" DISCHARGE = 1/4" I.P.S. FLOW = 305 C.F.H.	CO2 OUT = 0.0 CO OUT = 2.3 CO2 : CO = 0.0 CO IN = 2.6 D.P. IN = -51°C. D.P. OUT = -29°C. H2O OUT = .042%	CO2 OUT = CO OUT = CO2 : CO = CO IN = D.P. IN = -5 D.P. OUT = + H2O OUT = .9

L RESULTS

	CHARGE NO. 4				
HARDNESS Δ	COIL NO.	DECARBURIZATION		HARDNESS Δ	COIL NO
		BEFORE ANNEAL	AFTER ANNEAL		BEFORE
92/93	*1	.004 H.P.	.002/.004 M.P.	84/85	*1
93/94	2	.004 H.P.	.002/.004 M.P.	85/86	2
89/90	3				3
85/86	4	.003 L.P.	.004/.006 M.P.	90/91	4
84/85	5	.004 H.P.	.002/.004 M.P.	84/85	5
84/85	6	.004 M.P.	.002/.004 L.P.	84/85	6
	7				7
	8	NIL	NIL/.003 L.P.	90/90	8
	9				9
	10	.004 L.P.	.004 L.P.	85/86	10
	11	.004 M.P.	.004 M.P.	84/85	11
	12	.005 H.P.	NIL/.004 H.P.	80/82	12
	13				13
	14	.002 L.P.	.002 L.P.	94/97	14
	15	.006 H.P.	.002/.005 M.P.	84/86	15
	16	.005 H.P.	.004 M.P.	81/83	16
	17	.004 M.P.	.002/.004 L.P.	85/86	17
	18	.005 M.P.	NIL/.004 M.P.	85/86	18
	19				19
	20	.006 M.P.	.002/.004 L.P.	85/87	20

CO_2 OUT = 0.7 CO OUT = 2.0 CO_2 : CO = .35 CO IN = 2.6 D.P. IN = -50°C. D.P. OUT = -4°C. H_2O OUT = .435%	CO_2 OUT = 0.0 CO OUT = 2.8 CO_2 : CO = 0.0 CO IN = 2.8 D.P. IN = -39°C. D.P. OUT = -21°C. H_2O OUT = .093%	CO_2 OUT = 0.0 CO OUT = 2.8 CO_2 : CO = 0.0 CO IN = 2.8 D.P. IN = -46°C. D.P. OUT = -30°C. H_2O OUT = .037%	TESTING = 0.5 GAS REACTED: YES TO REACH SAFE CONDITION = 1.75 NEUTRAL COND. = 4.75 COMP. CYCLE = 10.0
CO_2 OUT = 0.9 CO OUT = 1.9 CO_2 : CO = .47 CO IN = 2.6 D.P. IN = -51°C. D.P. OUT = +9°C. H_2O OUT = .942%	CO_2 OUT = 0.5 CO OUT = 2.7 CO_2 : CO = .185 CO IN = 2.6 D.P. IN = -50°C. D.P. OUT = +2°C. H_2O OUT = .666%	CO_2 OUT = 0.0 CO OUT = 2.4 CO_2 : CO = 0.0 CO IN = 2.5 D.P. IN = -50°C. D.P. OUT = -20°C. H_2O OUT = .103%	TESTING = 2.0 GAS REACTED: YES TO REACH SAFE CONDITION = 19.5 NEUTRAL COND. = 33.5 COMP. CYCLE = 64.5

CHARGE NO. 5

DECARBURIZATION		HARDNESS Δ
BEFORE ANNEAL	AFTER ANNEAL	
.002 / .004 M.P.	.008 / .006 V.H.P.	85/86
.006 / .003 H.P.	.012 / .004 T.	85/87
.004 / .002 H.P.	.010 / .004 T.	90
.003 M.P.	.010 / .004 T.	84/85
.004 M.P.	.014 / .008 T.	88/89
.006 M.P.	.010 / .004 T.	88/89
.003 M.P.	.018 / .006 T.	84
.004 M.P.	.012 / 008 V.H.P.	86/87
.003 M.P.	.014 / .008 T.	88
.003 M.P.	.012 / .006 T.	86/87
.002 / .004 M.P.	.010 / .004 T.	83
.003 M.P.	.008 / .004 T.	89/90
.003 M.P.	.010 / .006 T.	83
.004 H.P.	.010 / .006 T.	88/89
.004 H.P.	.010 / .006 T.	82/84
.004 / .002 H.P.	.010 / .004 T.	83/84
.003 M.P.	.012 / .004 T.	83
.005 / .003 H.P.	010 / .006 V.H.P.	88/89
.003 M.P.	.010 / .002 T.	85
.003 M.P.	.008 / .004 T.	88/89

LEGEND

L.P. = LIGHT PARTIAL
M.P. = MEDIUM PARTIAL
H.P. = HEAVY PARTIAL
V.H.P. = VERY HEAVY PARTIAL
T. = TOTALLY DECARB'RD.

DECARBURIZATION = DEPTH IN THOUSANDTHS OF AN INCH

Δ = ROCKWELL "B" SCALE

* = TOP COIL OF CHARGE
D.P. = DEW POINT

I. C. = INNER COVER

Further decarburization of the steel in annealing was prevented, as the results show.

✦ ✦ ✦

Charge #4

THIS also was a full load of S.A.E. 3135 cold drawn rod coils. On this charge, a reaction took place, resulting in the formation of 0.7% CO_2 at 1000°F., at which time the CO dropped from 2.6% to 2.0%. The CO_2:CO ratio at this point was .35. An increase in H_2O is indicated,, due to this reaction.

✦ ✦ ✦

AFTER these reactions were completed and the atmosphere reached equilibrium, the CO of the discharge gas was the same as on entering for the balance of the cycle, with the H_2O content of -22°C to a point of 1250°F., when it dropped to -30°C at the end of the cycle. No further decarburization of the charge is indicated.

✦ ✦ ✦

Charge #5

THIS charge was a full load of S.A.E. 3135 cold drawn rod coils, pickled and washed. The procedure for this charge was different from the first four, in that no inner cover was used to enclose the charge. The furnace was of a sealed type construction, with the ends of the radiant tubes, which protruded through the furnace, sealed reasonably tight to maintain a small positive internal pressure. The bottom of the furnace had a base seal skirt immersed in the base oil seal. Both the inner and outer seals contained oil as a sealing liquid.

✦ ✦ ✦

THE refractory insulating material of the furnace casing was in contact with the atmosphere gas, which was circulated at twice the flow rate used for the charges annealed under the inner cover.

(Please turn to Page 262)

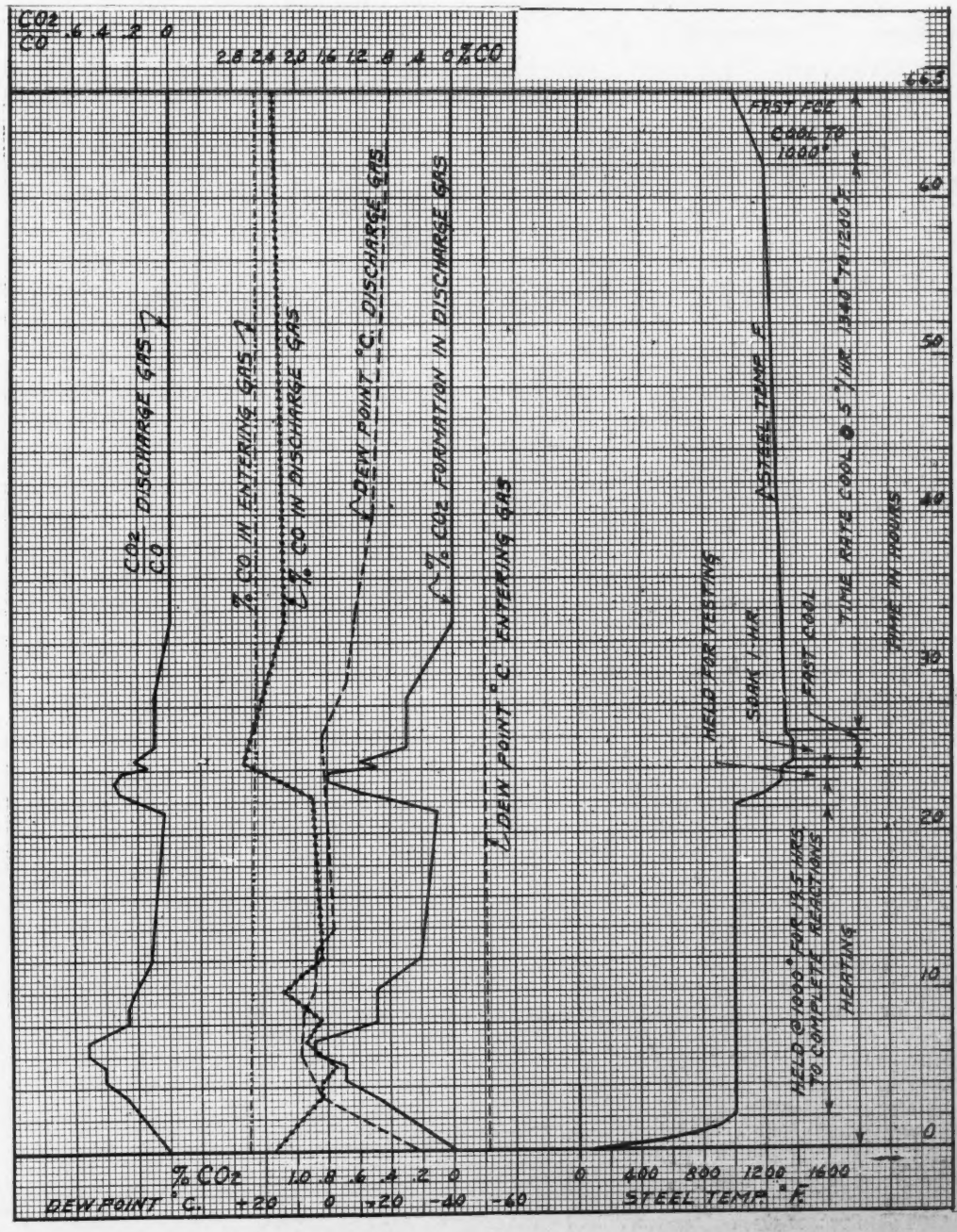


Fig. 9. Gas Equilibrium Chart Charge No. 5. S.A.E. 3135. 1390° F.

The Drawing of Synthetic Fibers

By S. Coppick

Acting Professor of Forest Chemistry,
State College of Forestry at Syracuse University,
Syracuse, New York.

This paper describes the process of drawing synthetic fibers and points out the analogies between the fiber and wire drawing industries. Apparently both of these industries are faced with the same fundamental problem, i.e. the unidirectional extension of matter, and principles which apply to one should apply to the other. ✦ ✦ ✦ ✦

Fiber Types

IN THE wire industries one is concerned principally with steel and copper, while the textile industry deals with viscose rayon, cellulose acetate, nylon and vinyon as the main artificial fibers as well as with cotton, wool and silk as the natural fibers. The drawing of the natural animal and vegetable fibers is a field in itself and will not be discussed here since its relation to the wire drawing industry is not quite so close as that of the artificial fibers. Furthermore, the distinction between the discontinuous and continuous states of fibers leads to more numerous analogies between the synthetics and wire drawing. For instance, wool and cotton exist as short staple lengths while rayon and nylon exist in both the short staple and the continuous filament varieties. However, with these latter synthetic fibers, the original spinning operation results in a continuum and its drawing is very similar to the continuous drafting of wire.

✦ ✦ ✦

AFTER the continuous drawing of synthetic fibers, they may be cut into short staple lengths and subsequently put through several single stage drafting operations similar to those commonly used on cotton drawing frames. However, it is not this but the original continuous drawing stages that are to be discussed herein.

✦ ✦ ✦

Spinning Processes

THE first main difference, between the spinning and drawing of fibers and the analogous wire drawing operation, is the physical state of the raw material. The liquid state replaces the solid rod.

✦ ✦ ✦

FIBERS are spun and drawn from the fluid, semi-fluid or plastic states. By fluid one includes both solutions and melts. For instance, rayons are spun from a solution of a chemical derivative of cellulose

SYDNEY COPPICK

in alkali in the case of viscose rayon and in acetone in the case of acetate rayon, while nylon is spun or extruded from a molten mass of the plastic material. One then has "solution" and "extrusion" spinning and drawing.

✦ ✦ ✦

A FURTHER subdivision of the "solution" process is the "wet" and "dry" spinning and drawing operations. These terms are used also in the wire drawing industry, but here they indicate an entirely different concept. A solution of the fibrous material must be regenerated either by coagulation in a fixing bath whereby the solvent is removed in the liquid phase, or the solvent may be eliminated by evaporation in a current of hot air. These processes constitute the "wet" and "dry" spinning operations. Viscose rayon is spun into an acid bath, while acetate rayon and vinyon are spun into hot air. In both cases of solution and extrusion spinning the mechanism of the drawing action is very similar and for convenience in the discussion of this operation the drawing in a "wet" spinning process will be considered in detail.

✦ ✦ ✦

THE drafting in the other processes is almost identical with the exception of course that in dry spinning the coagulating bath is replaced by a hot air column, and in extrusion spinning the bath is replaced by a cooling medium such as a cold stream of nitrogen gas in the spinning of nylon.

Spinning Operations

A SCHEMATIC representation of wet spinning is given in figure 1. Here the thick syrupy solution flows into a small gear pump, through a filter to remove undissolved particles and thence to the spinning jet. The jet may be regarded as the spinning analogy of the wire drawing die. It is a perforated platinum disc where the number of perforations vary from ten to several hundred depending upon the number of filaments desired in the final yarn. The hole or "die size" varies in diameter but is usually of the order of magnitude of several thousandths of an inch.

✦ ✦ ✦

ON coming into contact with the coagulating medium the solution is precipitated and the solvent is removed by diffusion. The fiber then appears as very plastic filaments. This fiber is taken over a guide to a revolving glass wheel known as a godet. The godet is the textile analogy of the wire drawing block. It is between the jet and the first godet that the first drawing operation takes place. A single draft of up to several hundred per cent extension may take place here. This is the jet and bath draft.

FOLLOWING the jet and bath draft, the fiber is further drawn by a process known as "godet stretching." Here drafting takes place between two glass wheels and up to several hundred per cent extension may be accomplished, depending upon the type of yarn being spun.

✦ ✦ ✦

THE yarn is finally collected through a funnel into a centrifugal pot, the speed of which determines the amount of twist put into the thread. Further processing of the cake which collects in the centrifugal pot consists of: washing, bleaching, dyeing, finishing, skeining and coneing. These latter processes are not of particular interest in a comparison of the fiber and wire drawing industries.

✦ ✦ ✦

WE see then that a typical synthetic fiber spinning process consists of two continuous drafting operations synchronized with continuous twisting. These operations have their counterpart in wire drawing and will be discussed in detail.

The Bath Draft or Jet Stretch

THE drafting which takes place as jet stretch is influenced by a number of variables. This drafting is not a true analogue of wire drawing since the yarn is in a very plastic condition when it first issues from the jet. The reduction in cross sectional area is more similar to that which is encountered in the hot rolling of steel rods, where almost true plastic flow takes place.

✦ ✦ ✦

IN the spinning industry one has two methods of controlling the degree of drafting in the bath: the speed of the pump "A" (similar to "back pull" in wire drawing) and the speed of the first godet "B" (the direct analogy of block speed.) The ratio of these two velocities determines the bath draft, and the total magnitude of either one determines the production.

✦ ✦ ✦

ANOTHER complicating factor which one encounters in the drawing of fibers is the "nature" of the draft. That is, the extent of the drawing during various stages of passage between the jet face and the first godet wheel. Conditions may be arranged so that most of the extension or stretch-

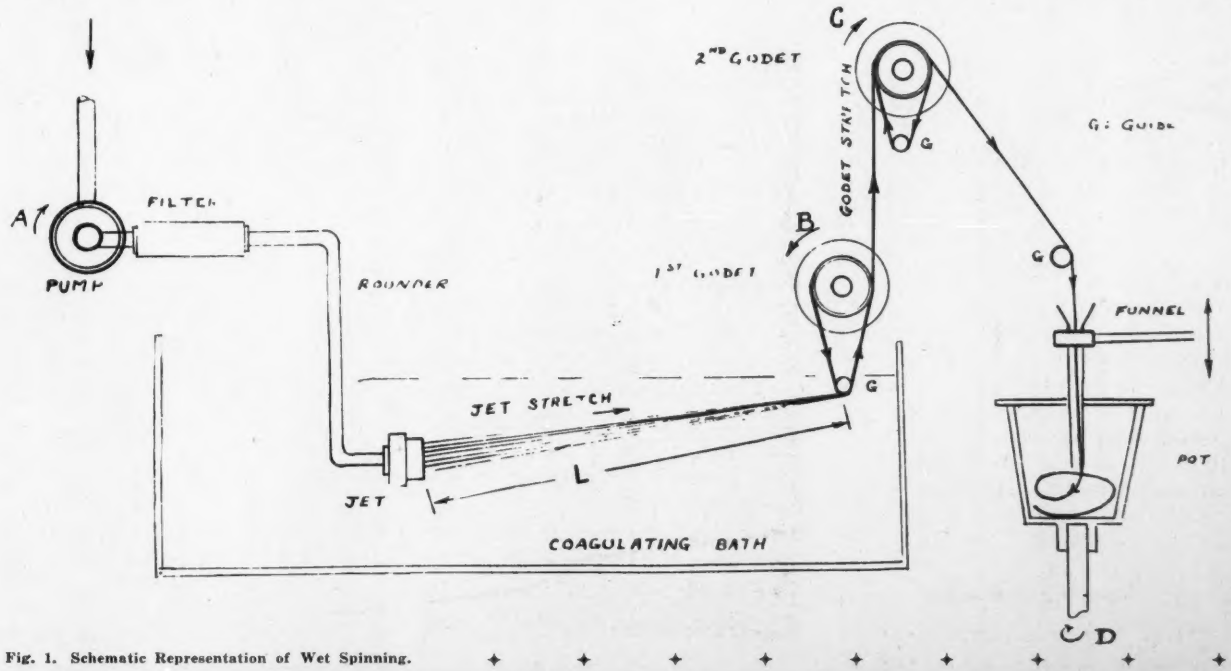
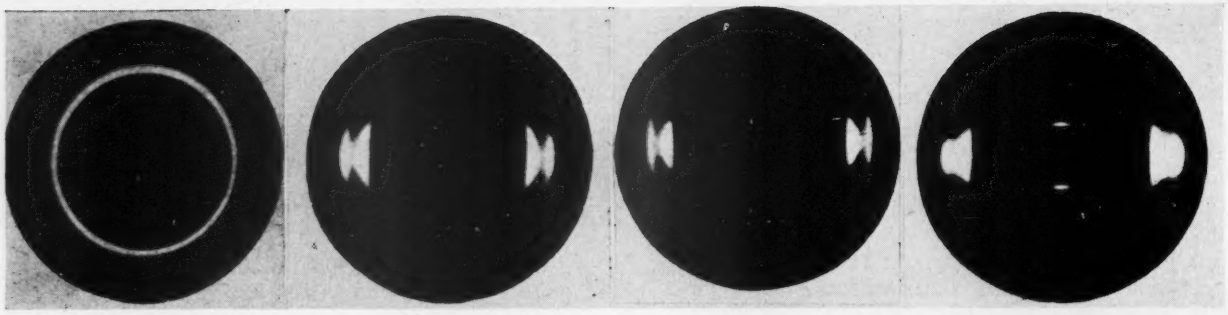
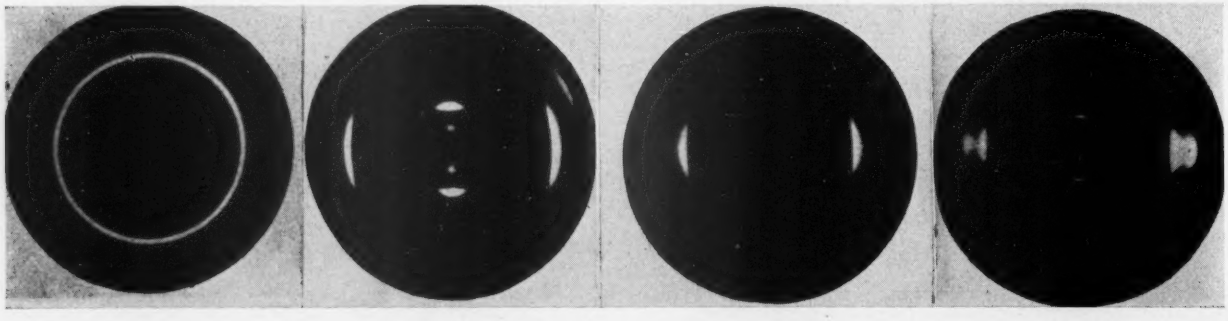


Fig. 1. Schematic Representation of Wet Spinning.



a b c d

Fig. 2. X-ray diffraction patterns showing the increase in orientation which results from increased magnitude of the godet draft. Increasing draft from yarns a to d. (Rayon type yarn)



a b c d

Fig. 3. X-ray diffraction patterns showing the increase in orientation which results from increased magnitude of the godet draft. Increasing draft from yarns a to d. (Nylon type yarn)

ing takes place within a few inches of the jet, while other conditions may be set so that a uniform stretching takes place over the whole of the length between the jet and the block.

✦ ✦ ✦

SIMILAR factors are met with in wire drawing, but they take place entirely within the die itself. With an appropriate die design it is conceivable that one might have the reduction in area taking place at one particular point in the die, while other die designs the drafting might take place over one-quarter to one-half inch during passage of the wire through the die. This is, of course, controlled by the appropriate angles of entrance, bearing and exit in the die itself.

✦ ✦ ✦

HOWEVER, it is seen that in spinning the control is wider since the path "L" of the yarn through the coagulating medium may be from a few inches to several feet. By varying this distance "L" one may obtain various different qualities in the finished yarn. Furthermore, in spinning there is another control of the nature of the drafting. By a suitable choice of the rate of coagulation or "setting up" one may have the drawing take place at various stages through the bath. For instance, a strong or rapid coagulation causes most of the drawing to take place within a few inches of the jet face, since at further points the yarn is much more rigid and little extension results. With a weak bath formulated for slower coagulation, the rate of spinning may be arranged so that the yarn has not lost very much of its free plastic flow until it reaches the first godet. Here then we will have a much more uniform and slower rate of drawing which will take place over the whole of the path throughout the bath. It is obvious that one may have also many intermediate cases between these two extremes.

THESE considerations are limited and controlled to some extent by the nature of the spinning solution itself. By choice of suitable concentrations of the fiber, age of the solution, presence of retarding agents, etc., spinning solutions may be prepared which have different coagulation rates. For example the concentration of alkali in a viscose solution will influence the coagulation rate, and whether or not one uses a more or less volatile solvent in celanese spinning will determine its drying velocity by variance of the volatility of the solvent. In the extrusion spinning of nylon this rate will be influenced by the temperature of the melt.

✦ ✦ ✦

ANOTHER control is, of course, the bath strength and composition. Acid and salt concentrations as well as temperature may be used to vary coagulation rates in viscose spinning. In dry spinning, where an air current replaces the liquid bath, one may vary the

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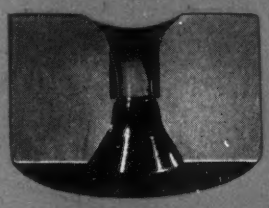

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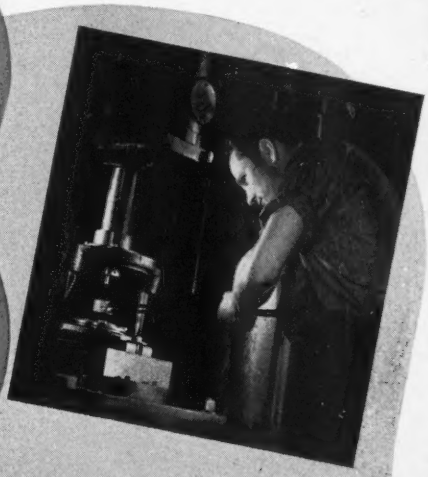
Above: Cross sectional photograph—life size—shows an R-2 taken from a well known mill where it was still operating satisfactorily at .254", or .126" over the maximum recommended hole size of .128"!



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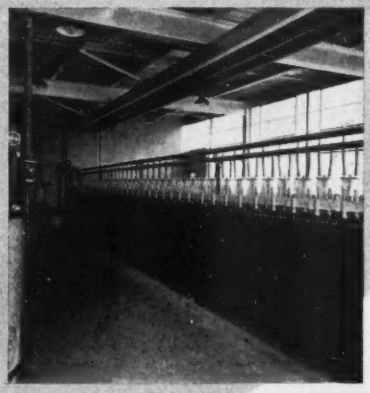

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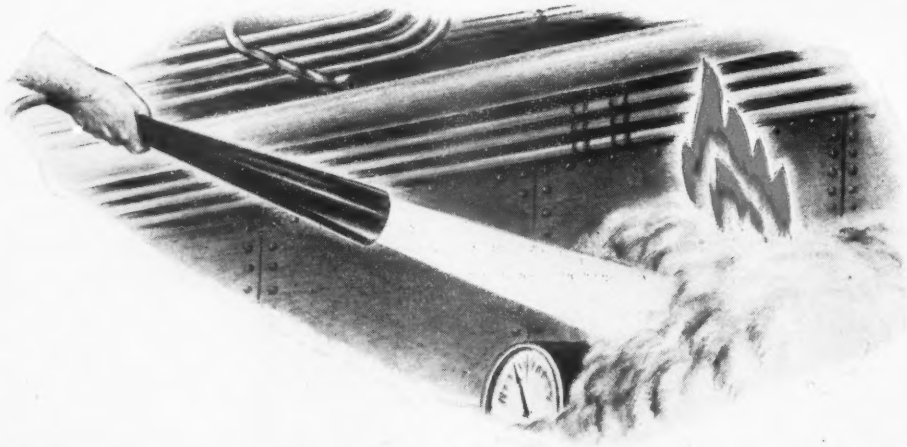

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velocity and temperature of the air so as to evaporate the solvent at any desired rate between the jet face and the first godet. In nylon spinning the temperature and velocity of the cooling current of nitrogen gas controls the nature of the draft.

✦ ✦ ✦

THIS then is the plastic or true stretch drawing of fibers and its control goes far in determining the properties of the resulting yarn.

✦ ✦ ✦

Godet Drafting

THE drafting which takes place between the first and second godet in the spinning operation is the direct analogy of wire drawing. With the exception that the textile industry employs no die, the process is exactly the same. Here one usually employs a direct stress to cause cold flow of the yarn, but in some cases the strain may be assisted by either hot air or a cascade of hot water or other swelling agent in order to make the filaments more plastic. Orientation of the molecules or crystallites takes place giving effects similar to the elongated grain structure of hard drawn wires. In fibers increased tenacity with a lowering of the elongation results from the godet draft. As in wires, very high drafting results in a more brittle and less flexible product. These properties are controlled by the ratio of the two godet speeds "B" and "C."

✦ ✦ ✦

Yarn Properties

AS HAS been noted above, the tenacity and stretch properties of yarns may be influenced by the godet stretch and are readily controlled as in standard wire drawing practice. The X-ray diffraction patterns of these yarns show increased orientation of the molecules or crystallites with increased godet drafting. These effects are identical with those obtained with wires. In figures 2 and 3 the diffraction patterns are given for yarns of the rayon and nylon types. Increased drafting of the yarn is in the order "a," "b," "c," "d." The continuous diffraction rings of "a" indicate a random arrangement of the crystallites resulting from little or no godet stretch. Shortening of the diffraction maxima into arcs in "b," "c" and finally approaching "point maxima" in "d," indicate a lining up of the crystal planes in a direction parallel to the fiber axis or the line of draft. Hard drawn wires exhibit a similar phenomena.

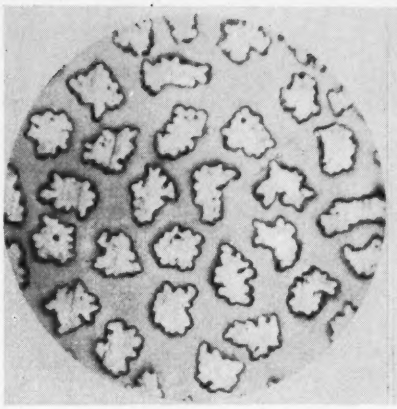


Fig. 4. ✦ ✦ ✦ ✦

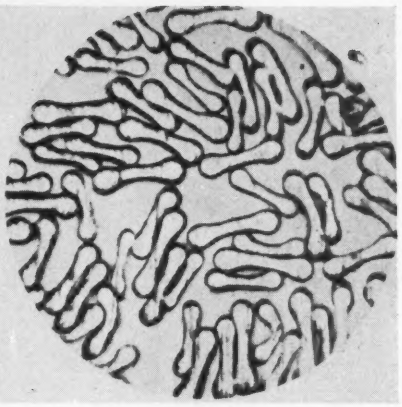


Fig. 5. ✦ ✦ ✦ ✦

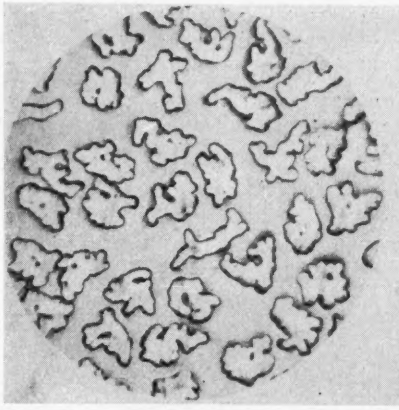


Fig. 6. ✦ ✦ ✦ ✦

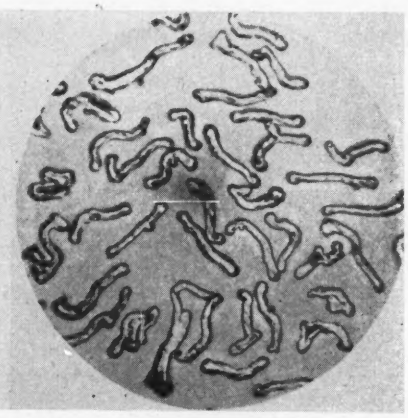
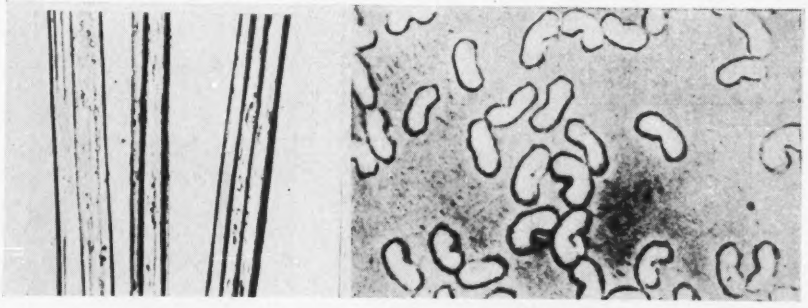


Fig. 7. ✦ ✦ ✦ ✦

Figs 4, 5, 6, 7. Photomicrographs of cross-sections of filaments in rayon yarns, showing the variation in cross-sectional irregularities which accompanies a variation of jet drafting conditions. ✦



a b

Fig. 8. Transverse and cross-sections of a bright rayon yarn. ✦ ✦ ✦ ✦

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ORIENTATION may be controlled to some extent also in the jet drafting operation, but this draft also introduces the complicated factor of varying irregular

(Please turn to Page 253)

Postwar Recommendations

By Frances Perkins,
Secretary of Labor, Washington, D. C.

SINCE Pearl Harbor, American industry has seemed to travel with Seven League Boots as our mills and factories moved forward from one production peak to another. This tremendous achievement has helped to make victory certain. Moreover, when we look beyond the war's end we begin to see new possibilities of higher living standards and increased well being for all of our people.

✦ ✦ ✦

IT takes no gift of prophecy to see this goal — the problem is how to reach it. So it is only natural in the midst of our concern for victory that industry, labor, and Government should think of what lies ahead after the war. Because the problems that will face us are bound to be numerous and complex it is especially desireable that we map beforehand the broadest possible area of agreement.

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THERE are a number of actions which I believe should be taken as soon as peace comes. They are designed to facilitate the rapid transition to normal peacetime economic activity and to reestablish and strengthen the standards that are desireable in the field of labor and employment.

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BEFORE presenting this program I would like to discuss briefly one very important step which will be much more effective if it precedes the end of the war. That is the extension of the social security system to embrace all workers, including farm and domestic workers. We already have unemployment insurance and old age insurance, as well as old age public assistance and public assistance for dependent children. The existence of this system gives a very real sense of stability to those who plan for the postwar period. Moreover, it will be the foundation for an expanded social system now generally approved.

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THE system should be made available to self-employed persons who wish to buy into it such as business and professional people, farm operators and others who "work for themselves." Benefits for unemployment extended in time to meet individual needs should be provided and probably more generous retirement benefits after 65 or 70. We will need to provide benefits for vocational rehabilitation, for disability due to illness or non-occupational accidents, benefits to cover hospitalization and even maternity benefits to families of insured persons. All of this is possible and is planned to detail.

✦ ✦ ✦

DISCHARGED war veterans should be admitted to social security automatically and be eligible to the various benefits, including eligibility for public works assignments as a part of unemployment benefits.

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THE recommendations which follow fall naturally into two groups. The first is concerned primarily with the labor force itself, the second relates chiefly to the field of business and financing. However, they are not mutually exclusive, on the contrary.

✦ ✦ ✦

HERE, then, are the steps that involve labor which I believe should be taken as soon as peace is declared:

Revocation of all permits which have been issued for the employment of minors for more than eight hours a day, or the employment of minors in ordinarily prohibited occupations.

✦ ✦ ✦

WARTIME demands have drawn children into the labor force to a much greater extent than many of us realize. Estimates for October 1943 place the total of young workers 14 through 17 years of age at about two and three-quarters million — 2 million 16 and 17 years old and ¾ million only 14 and 15. Thousands of still younger children are also at work, but we do not know the number because most official records make no count of them.

✦ ✦ ✦

THIS great influx of children into industry has brought back many old child-labor problems — a greater tendency to illegal employment, long hours, night work, and increased industrial hazards. It was inevitable that the growing demand for young workers would lead to pressure for the relaxation of child-labor standards, and as the war continues these pressures may be intensified.

Revocation of all permits for the work of women beyond 8 hours and for the work of women on the graveyard shifts.

✦ ✦ ✦

THERE has been a very marked increase in the number of such permits since Pearl Harbor. Data for three industrial states alone indicate that close to half a million factory women are working more than 8 hours a day or on night shifts. Some are doing both.

Promote the reduction of hours of labor under the Fair Labor Standards Act to 40 hours a week to help spread the work.

(Please turn to Page 250)

✦ GOVERNMENT WIRE PRODUCTION INFORMATION ✦

Shipbuilding Makes Heavy Demands On Copper Wire Industry

WELDING cable, containing enough strands of copper wire to girdle the earth nearly 1,000 times, is helping America's 77 shipyards, with their 300 shipways, attain phenomenal records in cargo ship production.

✦ ✦ ✦

APPROXIMATELY five merchant vessels per day are being produced by the 750,000 men and women shipyard workers, according to a survey by **H. W. Clough,** vice-president of Belden Manufacturing Company, manufacturers of wires and cables. Virtually all Belden production, including welding cable, is being channeled into war avenues.

AT the current production rate each shipway uses, for welding the plates, seams, and sections of merchant vessels, some 120,000 feet of cable per year or 36,000,000 feet for the 300 shipways. For purposes of flexibility and ease of handling, the average cable is composed of approximately 3,000 separately drawn strands of copper wire, making a total of 120 billion feet or 24,000,000 miles—enough to circle the earth nearly 1,000 times. In addition, there are many thousands of feet of multiple conductor power lead cable used by shipyards to connect welding with the sources of electric power.

✦ ✦ ✦

WITH the speed permitted by welding techniques, and with the help of the army of welders—including large numbers of women who have rapidly attained skill in this field — the nation's yards in ten months produced 15,501,624 deadweight tons for a total of 1,524 merchant vessels. Maintenance of this production average will fulfill the Maritime Commission's goal for the year.

✦ ✦ ✦

Copper and Wire Cable Industry Advisory Committee Meeting

THE above committee met in Washington on February 8th with E. W. Roath, Michael Schwarz, J. W. Mullally and E. H. Cross representing the Copper Division of the W.P.B., L. B. Flaws, Office of Industry Advisory Committee, four Officers of the U. S. Army and Navy and Alfred Bellis, John A. Roebling's Sons Co., H. L. Erlicher, General Electric Company, F. C. Jones, Okonite Com-

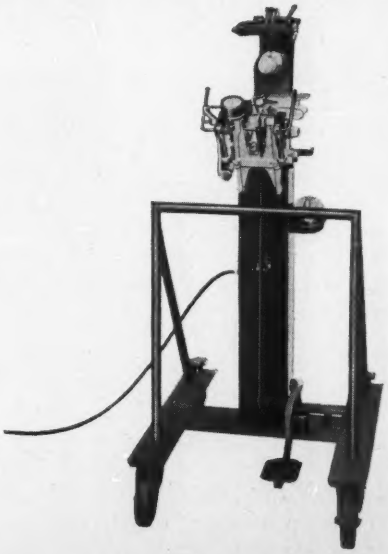
(Please turn to Page 244)

MICROMETER PRECISION MICRO-WELD TRADE MARK REG. U. S. PAT. OFF.

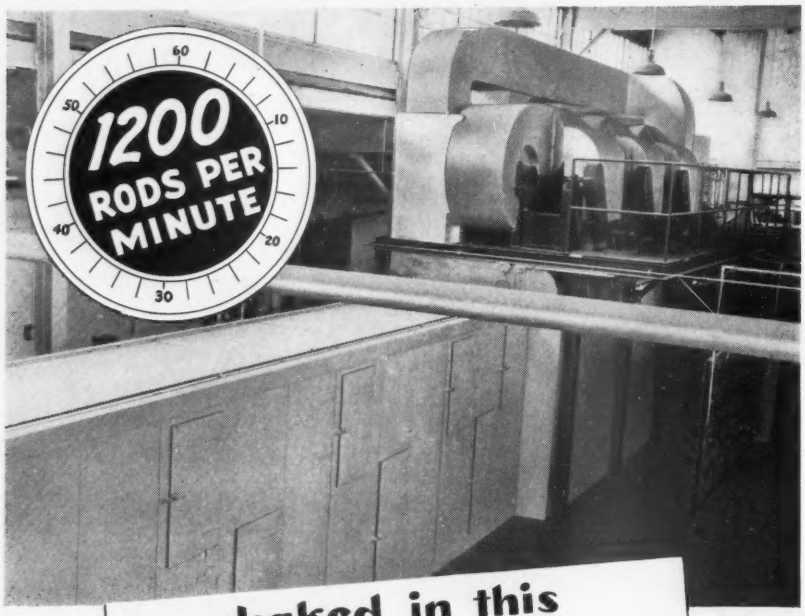
CONTINUOUS IMPROVEMENT

MICRO-WELDERS with dial indicating annealing attachments are now available for high carbon wire.

There is positive control of annealing temperature and already hundreds of these special MICRO-WELDERS are proving their dependability and satisfactory performance with leading manufacturers.



MICRO PRODUCTS COMPANY
20 NORTH WACKER DRIVE, CHICAGO 6, ILL.
Telephone, State 7468



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ROSS

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WELDING ROD

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ROSS Multiple Pass, Zone Controlled, Chain Conveyor Ovens not only maintain high quantity of output but produce hard, firm, dry coated rods of finer quality. These modern ovens are designed to handle the rods so as to protect the coatings while they are soft. Zone conditions of temperature, humidity and speed can be varied according to type of rod handled. ROSS "UNIVERSAL" Welding Rod Ovens are designed to meet your production requirements — to insure you against chipped or broken coatings.

The ROSS Testing Laboratory, one of the finest in America, is available for correctly determining proper baking conditions for your particular product. A ROSS engineer can put its facilities at your service—without obligation.

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ROSS ENGINEERING OF CANADA LTD.—Dominion Sq., Bldg., Montreal

Government Wire Production Information

(Continued from Page 243)

pany, C. A. Scott, Rome Cable Company and W. E. Sprackling, Anaconda Wire and Cable Company, in attendance.

✦ ✦ ✦

THE purpose of the meeting was to consider: (1) the availability of raw materials; (2) the substitution of a consolidated report for the numerous reports now being made to WPB on many materials; (3) new report forms; (4) warehouse stocks; and (5) suggestions from industry members on miscellaneous subjects.

✦ ✦ ✦

THE committee was informed that the directive issued by ORD on December 30, 1943, limiting the use of neoprene has been cancelled.

✦ ✦ ✦

BECAUSE a shortage of neoprene continues; industry members were asked to make suggestions concerning a list of types of insulated copper wire and cable in which use of neoprene is essential. It was the opinion of the committee that neoprene would be required for 5 and 10 pair, and spiral 4 for Signal Corps; and Navy type OP. Neoprene will be required for mining machine cables and high voltage shovel cables, it was stated, until Buna jackets are proved satisfactory.

✦ ✦ ✦

THE advisability of clearing the recommendations of the rubber insulated wire and cable technical committee of the ORD through the industry advisory committee was discussed.

✦ ✦ ✦

CERTAIN specifications which cannot be met unless the volume of production is considerably lowered were mentioned by industry members. It was pointed out that deviations from specifications which are authorized by claimant agencies to individual companies should be generally authorized to all companies.

STEPS have been taken to provide an adequate supply of cotton yarn to the industry, it was stated. Cotton yarns which are now particularly critical are: 14's—single; 30's—2 ply; 36's—2 ply; and 40's—2 ply.

✦ ✦ ✦

THE following reports were made in regard to the availability of other materials:

NAPHTHA—A sufficient supply is on hand.

SHEETING—Temporarily tight.

KALVAN—Distribution is being made by directive.

WHITCAB "R"—The supply is being increased and may be used as a substitute for Kalvan.

BUNA—The essential requirements of the wire and cable industry will be met.

LORASOAL and VYNITE—Allocations received a slight cut last month because the Chemicals Division was trying to balance inventories. The requirements of the industry will be met.

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INDUSTRY members stated that since their inventories of these materials were short, it would be helpful if the time lag between requests for material and allocation of material could be shortened.

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INDUSTRY members questioned the need for WPB 3505. It was explained that the information given on this form is necessary to check production for each of the claimant agencies and to assure allotments reaching mill level at an early date. It is hoped, however, that simplification of this form may be made. Major H. J. Beardsley (Army Service Forces) stated that the detailed data required by the form is necessary in making adjustments whenever a program is expanded or cut.

✦ ✦ ✦

THE suggestion was made that production of mining machine cable be cut by 50 percent since the supply on hand is now greater than the demand. The committee was informed that adjustments in the production schedules would be made to balance supply and requirement.

(Please turn to Page 246)

Where Spring Wire
earns its way!
As it runs through the feed guide and coiling point, under the pitch tool and cutter . . . every inch of ROEBLING SPRING WIRE earns its way. Earns its way in the form of more spring-dollars per foot of wire because finished springs come through every test—alignment, load, fatigue and finish—with flying colors. It's the result of closely controlling steel analysis and grain structure, holding tensile strength, ductility and dimensions to strict specifications.
Spring Wire, like all Roebling Wire Products, is custom-tailored to fit product requirements—to meet production quotas. Our trained manpower and wire-making facilities are ready to serve you—with either round, shaped, flat wires or strip steel for the specific job.
JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities
STRIP STEEL
FLAT WIRES
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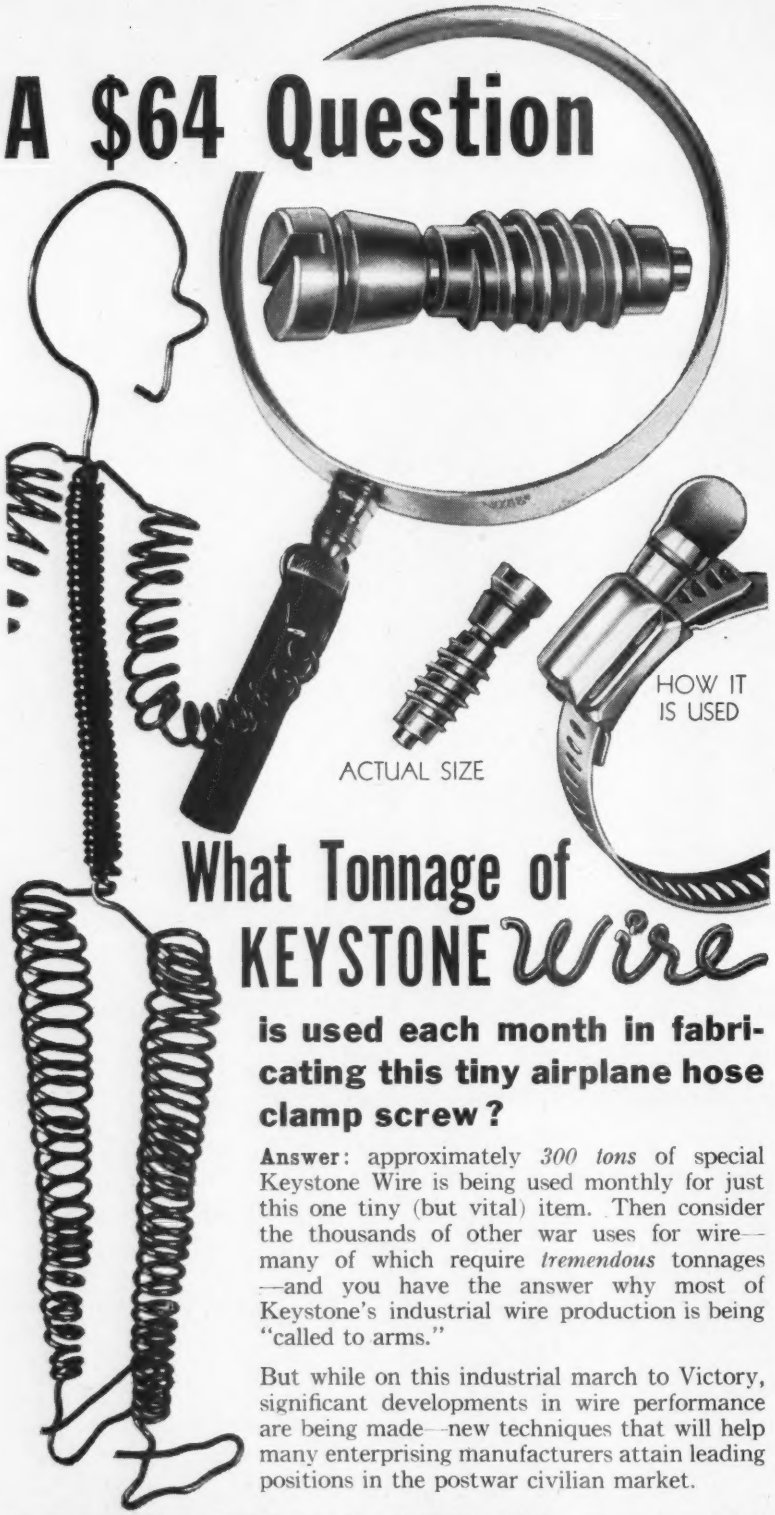
PACEMAKER IN WIRE PRODUCTS
WIRE ROPE AND STRAND • FITTINGS • AERIAL WIRE ROPE SYSTEMS • COLD ROLLED STRIP • HIGH AND LOW CARBON ACID AND BASIC OPEN HEARTH STEELS • ROUND AND SHAPED WIRE • ELECTRICAL WIRES AND CABLES • WIRE CLOTH AND NETTING AIRCORD, SWAGED TERMINALS AND ASSEMBLIES • SUSPENSION BRIDGES AND CABLES

A $64 Question



What Tonnage of KEYSTONE *Wire*

is used each month in fabricating this tiny airplane hose clamp screw?

Answer: approximately *300 tons* of special Keystone Wire is being used monthly for just this one tiny (but vital) item. Then consider the thousands of other war uses for wire—many of which require *tremendous* tonnages—and you have the answer why most of Keystone's industrial wire production is being "called to arms."

But while on this industrial march to Victory, significant developments in wire performance are being made—new techniques that will help many enterprising manufacturers attain leading positions in the postwar civilian market.

KEYSTONE STEEL & WIRE CO., Peoria, Ill.

Special Analysis Wire for All Industrial Uses

SAMSON SPRING WIRE

Continuing the march toward Victory depends on MORE SCRAP!

Government Wire Production Information

(Continued from Page 245)

MR. SPRACKLING suggested that membership on the industry advisory committee be changed periodically in order to give the Copper Division the benefit of advice of other experienced and outstanding men of the industry in furthering the war effort. This will be considered by the Copper Division.

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IT was suggested that the minutes of the meetings make it clear that all members of the industry should report immediately to the Copper Division of the War Production Board whenever any production problems are encountered, whether on materials, facilities, manpower or any other subject, the Copper Division being the Industry Division of all producers of Copper Wire and Cable.

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Miscellaneous Wire Products on Which Production May Be Increased

TOTAL number of bedsprings and box springs permitted to be made this year will be about 3,100,000 springs. WPB this week issued an order permitting manufacturers to make 50 percent as many bedsprings and box springs per year as they made in the base year, ending June 30, 1941. This is a 25 percent increase over previous permitted production.

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THE new springs will also be of better quality, because manufacturers are now allowed to increase the weight of steel used in the various units of coil, flat or fabric bedsprings and in box springs.

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PRODUCTION of innerspring mattresses for civilians is still prohibited. Resumption of production is not contemplated, according to WPB.

STEEL springs are now permitted in wood upholstered furniture—up to 50 percent of the dollar value used by the manufacturer in 1941. There is no restriction, however, on the amount of steel a manufacturer may use in any individual piece of furniture.

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FURNITURE with steel springs, prohibited for more than a year, has already appeared on the market.

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THE consumer can expect an eight percent increase in umbrella manufacture which will bring about five million umbrellas on the market this year. Production of umbrella repair parts is allowed to be doubled as compared to last year's production.

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BRASS instead of steel eyelets (which rust) may now be used on white shoes. All restrictions have been removed on the use of steel for hooks and eyes, snap fasteners and brassiere hooks. The ban on production of slide fasteners of more than 27 inches in length for civilian use has been lifted. Steel buckles for shoes and clothing, previously prohibited, may now be used.

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NO electric irons are yet being made, but a WPB order permitting manufacturers to make 2,000,000 electric irons for civilian use and 76,000 for Army, Navy, Maritime Commission, Lend-Lease and export purposes was issued February 24. The number of electric irons to be manufactured is about 43 percent of 1940's output.

✦ ✦ ✦

BLADES for civilians are being shipped currently to retailers at 91 percent of the 1940 rate of shipment within the United States. The number of blades made available to civilians is, therefore, ex-

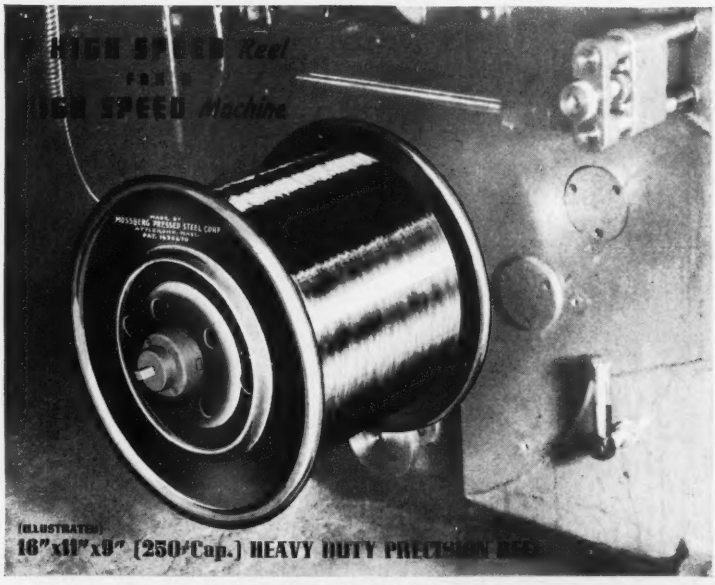
(Please turn to Page 248)

Manufacturers of materials, tools and equipment for wire drawing and forming plants are constantly making improvements and additions to their lines. If you do not find the product or service in which you are interested, additional information will be supplied promptly. Simply address:

WIRE & WIRE PRODUCTS

Stamford Trust Co. Bldg.

300 Main St. Stamford, Conn.



MOSSBERG PRESSED STEEL CORP.

OFFERS: BALANCED PRECISION REELS

in HEAVY DUTY construction for use on modern HIGH SPEED wire drawing machines.

To provide higher operating efficiency, with the ever increasing tendency towards the drawing of finer gauge wire on larger reels at higher speeds, the following reel requirements are now essential:

(1) PROPER PROPORTION
(2) BALANCE
(3) ACCURACY
(4) STRENGTH
(5) DURABILITY

All these requirements are incorporated in spools & reels made by

MOSSBERG PRESSED STEEL CORP.

18 WEST STREET ATTLEBORO, MASS., U. S. A.

Government Wire Production Information

(Continued from Page 247)

tremely high, since this is in addition to shipments to the military. In the last quarter of 1943, more than 700,000,000 razor blades were made. There is now no limit to the production of razor blades, except by the amount of materials that WPB can make available for this item.

WPB Revokes Order M-225 on Material Handling Equipment

IN line with the War Production Board policy to bring all scheduling under General Scheduling Order M-293, revocation of General Preference Order M-225, dealing with overhead traveling cranes has been announced.

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DELIVERIES of such cranes in the future will be scheduled under General Scheduling Order M-293, under immediate jurisdiction of the WPB Tools Division.

✦ ✦ ✦

THE order revoking M-225, however, points out that no liabilities that were incurred under it are affected by the action. Overhead traveling cranes, together with rotary, locomotive and gantry cranes, monorail systems for motor driven cranes and carriers, chargers and manipulators, are brought under the jurisdiction of the Tools Division by Table 12, as amended February 19, 1944, to General Scheduling Order M-293.

✦ ✦ ✦

OVERHEAD traveling cranes are designated Class X products under Order M-293, which means that monthly reports on proposed delivery schedules must be filed with WPB. After March 1, many producers may be excused from filing these monthly reports, however.

✦ ✦ ✦

WPB Eases Restrictions on Ferro-Alloys and Stainless Steel

THE War Production Board has announced removal of restrictions on the utilization of steel mill production facilities for the fabrication of corrosion- and heat-resistant chrome steel and on the use of ferro-alloys. At the same time, the WPB "unfroze" stainless steels held by producers and consumers. This action will have no effect, however, upon new production and little effect on use of existing inventories. The specific step taken by the WPB is the revocation of Supplementary Order M-21-d. This order was originally issued when facilities and ferro-alloys were scarce and many controls had to be set up to assure maximum supplies of metals for the war program and to recover the alloys contained in such steels for remelt.

✦ ✦ ✦

WPB Modifies Conservation Order M-126

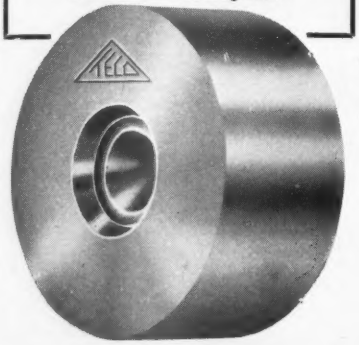
THE War Production Board has announced a few relaxations of restrictions on the use of iron

Maximum production of smooth, on-size wire requires dies that wear smoothly — as well as slowly. Dies that pit and crack may draw costly runs of reject wire before the damage is discovered.

TECO Cemented Carbide is slow wearing because of its intense hardness — smooth wearing because of its uniform, dense structure. Result: Greater tonnage per die — fewer stoppages for die changes — less rejects for poor finish.

Prove these facts. Make a test run with TECO Cemented Carbide Dies. Let us know your needs.

Wire and Bar Dies—Sizing Dies
Extruding Dies — Tubing Dies
Also Carbide Blanks, Tools, Bits, Reamers and Forming Tools.



TUNGSTEN ELECTRIC CORPORATION, 564 39th St., Union City, N. J.

Branch Office: 2906 Euclid Avenue, Cleveland, Ohio

Representative: Architects & Builders Bldg., Indianapolis, Ind.

TECO Pioneers in Tungsten Carbides for over a Quarter Century **CARBIDE DIES**

and steel for various civilian products. In all cases, fabrication of the civilian goods was permitted by the terms of limitation orders, but iron and steel were unobtainable because of prohibitions contained in Conservation Order M-126. To remove this conflict and to make steel available for uses not previously permitted, M-126 has been somewhat modified.

✦ ✦ ✦

PERMITTED under the amended order is metal for: automotive heaters, hose reels, grease guns, grease pumps, oil pumps, 150 tons of low grade steel wire for hat brims, cigarette lighters, motion picture projectors, motion picture sound producing equipment, window shade rollers for street cars and buses, and stencils. How soon these products will reach ultimate consumers is problematical.

✦ ✦ ✦

WPB Permits Disposal of Rejected Steel

PRODUCERS and distributors of steel, who have off-grade or rejected steel or idle and excess inventories of steel which they are unable to move under CMP Regulations, may apply to WPB for permission to dispose of such material, the War Production Board announced on January 22nd.

✦ ✦ ✦

APPLICATIONS for permission to make such sales should contain (1) the name of the proposed customer, (2) the product to be made, (3) description of the material, (4) location of the material, and (5) length of time held and reason holder has been unable to move it under CMP Regulations.

✦ ✦ ✦

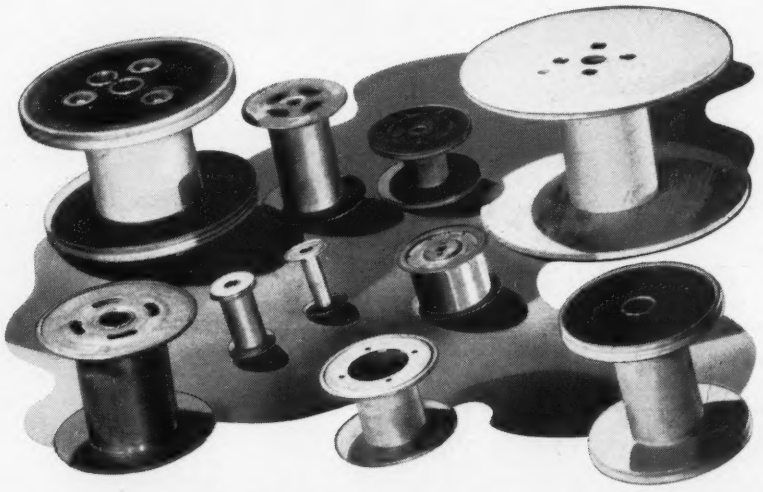
STEEL producers' applications should be addressed to the appropriate Products Branch of the Steel Division, War Production Board, Washington 25, D. C. Distributors' applications should be addressed to the Warehouse Branch of the Steel Division also in Washington.

WPB Reduces Paper Work on Purchases and Deliveries

IN an effort to save paper work and time in the handling of applications for authorization to purchase or deliver equipment, the War Production Board has announced the approval of a new and standardized form to take the place of the 20 that previously covered 52 items of equipment.

THE new form to be known as WPB Form 1319, will supplant the old variations of WPB Form 1319, as well as many others and will cover the entire field with the exception of those coming under the head of the old PD-1A and PD-3A, which are applications for certain preference ratings.

(Please turn to Page 250)



ADDED STRENGTH

SAVES REPLACEMENTS

When You Use HUBBARD Spools and Reels

Wire producers everywhere have learned that spools and reels needing frequent replacement are expensive at any price. That's why so many now standardize on extra-strong Hubbard spools and reels.

Features such as electro-welded construction and patented die-formed head tires characterize Hubbard products. For example, Hubbard wooden spools and reels, with patented "Bulldog Grip" steel tires, are chip-proof and split-proof, withstand hardest abuse. Their longer service life sharply reduces time spent in ordering, handling and installing replacements.

Get all the facts about these *engineered* Hubbard products. Write us about your operations—we'll send full details on Hubbard spools and reels to help reduce your operating costs.

HUBBARD SPOOL COMPANY

1624 CARROLL AVENUE | CHICAGO, ILLINOIS

Since 1912, manufacturers of wire drawing and annealing, and shipping spools and reels.

Postwar Recommendations

(Continued from Page 242)

IN October, 1943, average hours worked in all manufacturing industry were 45.4, which means a scheduled workweek of about 48 hours. For durable goods the average hours worked were 47.3, indicating a schedule of close to 50 hours a week. These averages include figures for individual industries that are well above 50 a week.

Revoke Executive Order 9240 (which governs the overtime and premium pay practices on "all work relating to the war", and abolish Sunday work, holiday work and overtime work so far as possible.

Unfreeze labor under the War Manpower Commission's right to issue directives and reestablish the freedom and mobility of American Labor.

Make the U. S. Employment Service a strong and effective instrument for moving workers out of war industries and into civilian industries.

✦ ✦ ✦

INCLUDING the placement of men returning from the armed forces, it seems probable that at least 25 million job shifts and transfers will be necessary before our economy settles into a normal peacetime pattern.

Set up a fund which can be loaned through the U. S. Employment Service to help workers who have no money to get back home or to reach a place where there might be opportunity for employment.

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THIS problem too is apt to be more serious than many of us realize. There are many plants that may close permanently when the war ends or require a very long period for reconversion. In the smaller communities where workers were recruited from distant points large numbers may be stranded with little or no chance for local work. In ten States the estimated military and industrial demobilization is 35 percent or more of total 1940 employment.

Encourage the immediate retirement of those above 65 on their old age pensions.

✦ ✦ ✦

THE best estimates place about three-quarters of a million persons in this category.

Encourage the return to education of any person under 20—to school or college or vocational training institutes.

✦ ✦ ✦

HIGH school enrollment for the country as a whole has dropped 15 percent in the last three years. And there is no doubt that a great many in the armed forces will want to resume their education or undertake special training along some other line.

Advise and assist women who took jobs only because of the war need to leave the labor market and make opportunity for girls and women who must work regularly.

✦ ✦ ✦

WHILE a number of women now employed are not what could be called a part of the normal labor force, we must remember that 11 million women were employed in the spring of 1940 and another 2½ million were hunting jobs. Thus a sizeable army of women will need work when the war is over.

✦ ✦ ✦

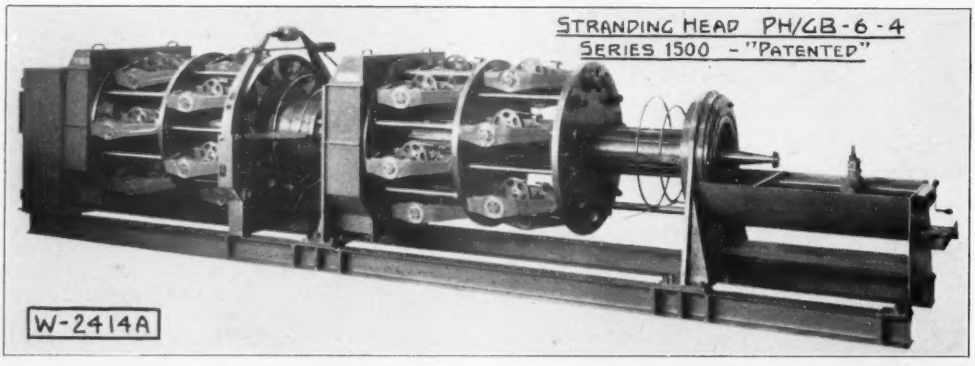
THESE steps, which can be carried out with a minimum of

THE WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON, NEW JERSEY, U. S. A.

ELECTRICAL WIRE AND CABLE AND WIRE ROPE MACHINERY



24-SPOOL, HEAVY DUTY, FLAT RETRACTING-PINTLE
VARIABLE - GEAR - BACKTURNED CRADLE
ALL - STEEL - ROTOR STRANDING HEAD

(BUILT IN 30, 100, 220 AND 600 POUND SPOOL SIZES)

delay once the war is ended, will provide an anchor to windward for millions of working people. And they should fit smoothly into any broader program which may be adopted.

✦ ✦ ✦

THE suggestions which follow lie outside the scope of the Labor Department, but they all relate to the immediate postwar period.

Provide for proper Government assistance for loans to businesses which can reconvert quickly and manufacture or distribute civilian goods for which there is a market and which will provide large employment.

Encourage and revive the luxury, transportation, and amusement industries and trades which are healthy and good for the public judged by normal standards.

Develop Government aid for settling certain qualified groups on the land with a scientific program of assistance in crop planning and marketing and supervision.

Open up the planned public works in those localities where there appears to be a considerable pool of permanent residents for whom no private employment is immediately available.

✦ ✦ ✦

A VARIETY of public works programs have been developed on a local and regional basis. Must of the program is already engineered and audited and can be put into operation quickly. In some localities it may be necessary for the Government to develop a public works program geared to meet community needs.

Renew all the techniques of stabilized employment which were partly developed during the last depression, such as orders in advance; extension of rural electrification, manufacturing, Government and other capital industry orders on a regular basis.

✦ ✦ ✦

AT the same time we will need a carefully thought out program for disposing of surplus stocks held by various Government agencies—the purpose being to release these materials without upsetting wholesale and retail markets.

Release the housing programs now found to be necessary and give appropriate Government assistance to provide both construction of houses and housing improvements.

✦ ✦ ✦

THERE is no intent to by-pass or side-track private housing construction. But past experience and the status of present plans indicate that both publicly and privately financed housing developments will be required if we are to meet the pent up need for good homes and at the same time provide an important stimulant for business revival generally.

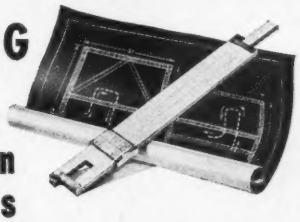
Encourage normal purchasing by the public through carefully planned and systematic use of war savings rather than speedy, reckless spending.

✦ ✦ ✦

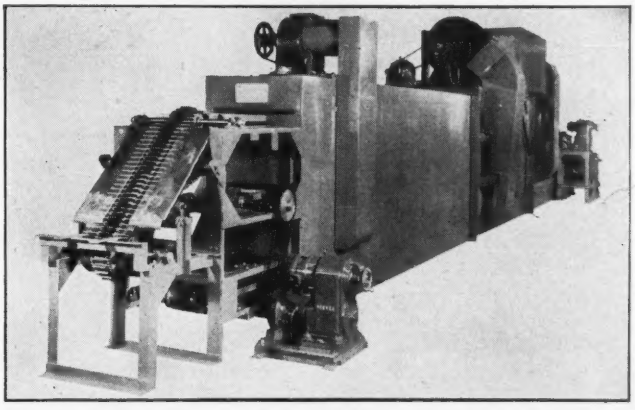
BUSINESS and industry can do a great deal here to guide the buying public and also help to develop an orderly, predictable consumer demand. The consumer demand for goods of every kind will be high. The American working man has savings today—some of them in war bonds, some in banks, and still more in the stocking. This fact suggests to thoughtful observers that the banking facilities of the country may not be fully adequate for workers who save.

(Please turn to Page 252)

OVEN ENGINEERING NEWS



Continuous Drying Oven For Welding Electrodes



Completely automatic and requiring only casual human supervision, this machine loads, drys, bakes, cools and presents for inspection 600 welding rods per minute. An automatic loader picks the rods up from a stripping machine, and a system of conveyers and transfer elevators carries them through the drying, baking and cooling zones.

SINGLE HEATING UNIT

A single heater produces the various temperatures. Wide variations of drying and baking times, with each zone completely independent of any other zone, allow the unit to be operated on most types of coatings.

NO JAMMING

Transfer conveyers are foolproof and lower rods from zone to zone without jamming or bending. Automatic control of all temperature and burner operations competely relieves the system of attendants. The entire unit is 65 feet long and only 5 feet wide, conserving floor space.

FREE ENGINEERING BOOK

Write for your copy of "Blueprint for Industry", containing numerous drawings and descriptions of unusual oven and conveyer systems, along with other interesting engineering data.

(This is No. 9 of a series. Reprints of previous advertisements will be sent free upon request.)

THE INDUSTRIAL *Oven Engineering* COMPANY

11621 Detroit Avenue **Cleveland, Ohio**

Postwar Recommendations

(Continued from Page 251)

Savings banks are not developed throughout the country. Those that there are, like other banks with savings departments, have the usual limited hours which may be very inconvenient for working people on payday. Moreover, in some large areas the distance to a bank makes it almost prohibitive to deposit regularly.

Encourage people to buy permanent consumer's goods, like refrigerators, vacuum cleaners, furniture, automobiles and necessary textiles.

Encourage cultural and recreational activities as a means of employment as well as a method of achieving a sound and balanced society.

✦ ✦ ✦

THE purpose of this combined program is apparent. It offers a real measure of protection to millions of workers during the transition period and at the same time seeks to create wider opportunities for employment and the full use of all our resources in men, materials, and machines.

✦ ✦ ✦

BEYOND this are long-haul objectives which will require vision, persistence, and fidelity to the ideas of unity and human values.

✦ ✦ ✦

Government Wire Production Information

(Continued from Page 251)

THE new form, covering four pages, will have the same places of filing, same number of copies, and same methods of processing as the present forms. The net result is that only one instruction book and one form will control such applications. Copies of the instruction book will be included in "Products and Priorities," monthly publication of the board designed to keep executives and manufacturers informed on current orders and forms.

New Divisions Created for Electrical and Wire Rope by American Steel & Wire Co.

OWING to the volume and detail of electrical and wire rope business, the American Steel & Wire Company is creating two separate divisions to handle the sale of electrical products and wire rope and construction materials. **P. T. Coons,** formerly head of the electrical, wire rope and construction materials department, which is being discontinued, will assume the responsibilities as manager of the wire rope and construction materials division. **T. F. Peterson** has been appointed manager of the newly created electrical division. At the same time, **B. M. Ashbaucher** has been made assistant manager of the wire rope and construction materials division, while **C. H. Eisenhardt** has been named to a similar position in the electrical division.

THE PITTSBURGH REGIONAL MEETING

OF THE

WIRE ASSOCIATION

Will convene at 6 p. m., Friday, May 19, 1944, at the

WILLIAM PENN HOTEL, PITTSBURGH, PA.

Present plans include an entertaining speaker, who will address us briefly. Technical papers on the cleaning of rods and the use of the new coating compounds, a talk on our man-power outlook for the balance of the year, and a war motion picture will be the features.

The registration fee, which will include a good dinner, will be $4.00. As a special courtesy to those who cannot arrive in time for dinner, a fee of $2.00 will be charged to the technical session only, which starts at 8 p. m.

We want you to be there and hope you can arrange to be with us for dinner. Members may bring guests. This will be an important session; don't miss it!

To enable us to make adequate dinner reservations, you are asked to advise us promptly as to your attendance and the number of guests you will have—specify the dinner or the technical session. Please send reservations to

RICHARD E. BROWN
Executive Secretary

300 MAIN STREET — STAMFORD, CONN.

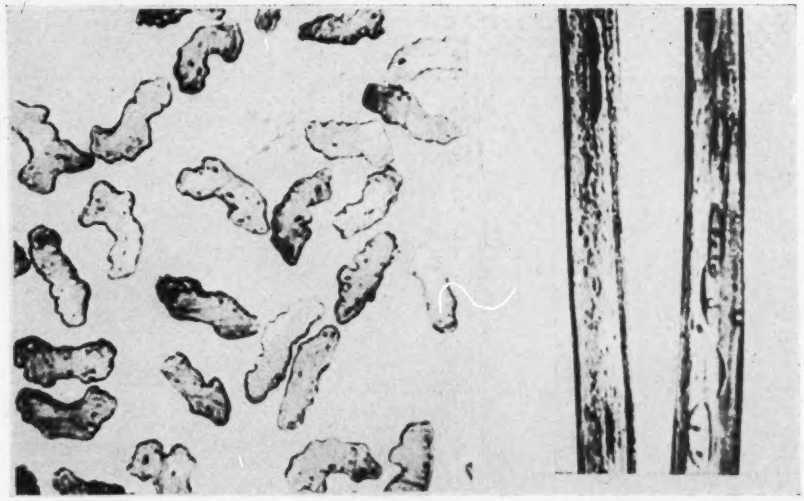
The Drawing of Synthetic Fibres

(Continued from Page 241)

cross-section. The cross-sectional contours of a filament in a yarn greatly influence its texture. Such terms as lustre, handle, softness and harshness are used to express the quality of the fiber.

✦ ✦ ✦

VARIATION of the jet drafting conditions bring about not only varying tenacity and stretch, but also influence the rate of diametrical shrinkage of the filaments and so affects the shape of their cross-sections. In figures 4, 5, 6 and 7 the various types of irregular and regular filaments are shown. Figures 8 and 9 illustrate the effect of cross-sectional irregularity on the light diffraction and reflection from the filaments themselves. Hence we may have fibers bright drawn, dull, lustrous, etc., similar to the analogous drawn wires.



B A

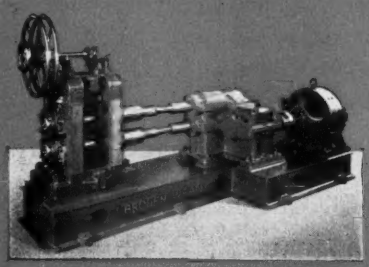
Fig. 9. Transverse and cross-sections of a dull rayon yarn.

✦ ✦ ✦ ✦

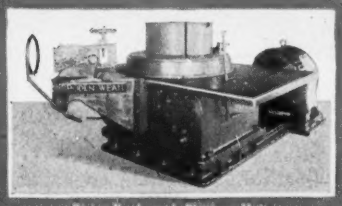
Conclusions

FROM the points brought out in this paper it is concluded that both the synthetic fiber and wire drawing industries are engaged in a process involving the same fundamental principles, and numerous analogies are apparent when fiber spinning and wire drawing are compared. It would appear that closer cooperation and exchange of information between these industries might be beneficial to both.

WEAN-BRODEN



Small Cold Rolling Strip Mill



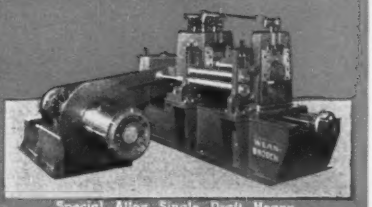
Strip Reel and Slitting Unit

THE Wean Engineering Company, Inc., have long been recognized as specialists in sheet, strip and tin mill equipment . . . The Broden Construction Company specializes in the manufacture of narrow strip and wire mill equipment.

With the extended facilities of The Broden Construction Company as a subsidiary of The Wean Engineering Company, Inc., it is now possible to serve the steel industry more effectively.

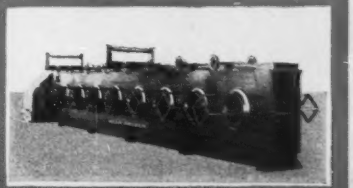
COLD ROLLING MACHINERY
For 36" Wide Material and Narrower
Mills • Reels • Slitters • Levelers • Coilers
Edgers • Scale Breakers • Shears
Scrap Ballers • Continuous Pickling

WIRE MILL EQUIPMENT
Wire Drawing Machines • Patenting
Galvanizing and Tinning Take-Up Frames
Wire Flattening • Spoolers • Nail
Galvanizing and Blueing



Special Alloy Single Draft Heavy Duty Vertical Wire Drawing Block for ⅜" Round Wire

HOLMQUIST BARBED WIRE and WIRE FENCE MACHINERY



The BRODEN CONSTRUCTION Co., Inc., Cleveland, O.
A SUBSIDIARY COMPANY OF
The WEAN ENGINEERING Co., Inc., Warren, O.

A Review of Recent Wire Patents

No. 2,340,340, WINDING MACHINE, patented February 1, 1944 by Ernst A. Nordberg, Sharon, Mass., assignor to Production Development Corporation, Canton, Mass., a corporation of Massachusetts.

A machine for making condenser windings of the type described in which foil and paper is supplied from continuous rolls of material and the windings comprise a number of sheets of condenser foil and paper.

✦ ✦ ✦

No. 2,340,448, APPLYING TERMINALS TO WIRE SEGMENTS, patented February 1, 1944 by Karl H. Andren, Milwaukee, Wis., assignor to Artos Engineering Company, Milwaukee, Wis., a corporation of Wisconsin.

Segments of insulated wire are severed from the wire supply, their ends stripped of insulation, and the terminals secured thereto.

✦ ✦ ✦

No. 2,340,808, EXTRUSION NOZZLE WIRE GUIDE, patented February 1, 1944 by Frederick A. Gruetjen, Milwaukee, Wis., assignor to A. O. Smith Corporation, Milwaukee, Wis., a corporation of New York.

A wire guide is provided aligning a rod with an extrusion nozzle for applying a coating thereto having a predetermined tolerance limit of eccentricity.

Complete Descriptions and Drawings of Patents May Be Had for 25 cents; outside United States and Canada, $1.00. Address, Wire & Wire Products, 300 Main St., Stamford, Conn.

No. 2,340,996, COATING COMPOSITION, patented February 8, 1944 by William H. Smyers, Westfield, N. J., assignor to Standard Oil Development Company, a corporation of Delaware.

The method of preventing corrosion of metal surfaces in an atmosphere of high humidity is patented and comprises coating the surfaces with an organic composition consisting essentially of mineral oil hydrocarbons blended with a small proportion of an onium compound containing at least 10 carbon atoms per molecule in alkyl radicals and having substantial solubility and sufficient concentration in the hydrocarbons to prevent moisture and air from contacting with the metal surfaces.

✦ ✦ ✦

No. 2,341,015, WIRE EXTENSION MEANS FOR SPRING STRUCTURES, patented February 8, 1944 by Svend G. Blumensaadt, Cleveland Heights, and William H. Neely, Cleveland, Ohio, assignors, by mesne assignments to the Universal Wire Spring Company, Cleveland, Ohio, a corporation of Ohio.

The wire extension means is forwardly and rearwardly extended of a front edge wire and coupled with some of the springs of the spring structure. It includes identically constructed, partly overlapping wire elements arranged symmetrically and in reversed position with respect to each other and the spring structure.

✦ ✦ ✦

No. 2,341,235, INSULATED ELECTRICAL CONDUCTOR AND METHOD OF MANUFACTURE, patented February 8, 1944 by Dwight R. G. Palmer, South Orange, N. J., assignor to General Cable Corporation, New York, N. Y., a corporation of New Jersey.

A continuous metal tube surrounding the wire, and a highly compressed layer of pulverized mineral fibre surrounding and spacing the wire from the metal tube.

✦ ✦ ✦

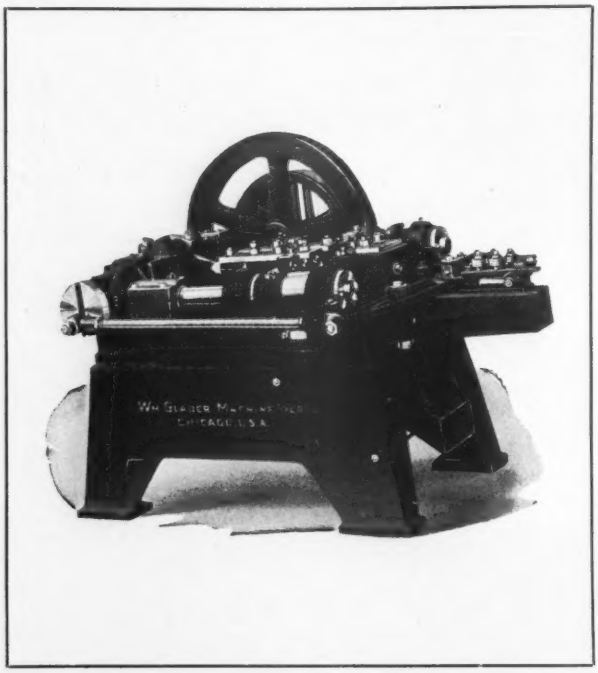
No. 2,341,369, WIRE COILING MECHANISM, patented February 8, 1944 by Charles W. Fornwald, Jr., Linden, N. J., assignor to Syncro Machine Company, Rahway, N. J., a corporation of N. J.

A wire guide pulley is provided, adapted to be bodily shifted through an angle of 90° to throw the wire therefrom after which it is wound on the main spool.

✦ ✦ ✦

No. 2,341,419, FURNITURE, patented February 8, 1944 by Albert M. Bank,

GLADER HIGH SPEED WIRE NAIL MACHINE



High tonnage output, and low maintenance costs, have resulted in Glader Machines being accepted as standard equipment in every large nail mill built in the United States in the past twenty years.

Glader Machines are operating in most of the wire producing mills throughout the world.

These machines are made in eleven different types and sizes. This enables us to cover the range of sizes of nails produced with the greatest efficiency.

For further information please address,

WM. GLADER MACHINE WORKS

210 NO. RACINE AVE.
CHICAGO, ILLINOIS

Jersey City, N. J., assignor to Sylvia Bank, Jersey City, N. J.

Auxiliary springs are included, secured to the frame at one end of each spring, at intermediate portions to the main springs, and having, at their opposite end, a free-flexing portion secured to a border wire.

✦ ✦ ✦

No. 2,341,450, STRAND TREATING APPARATUS, patented February 8, 1944 by Peter J. Knaus, Hinsdale, Ill., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

An extrusion die of resilient material is provided, having an annual recess, so as to render the center portion of the extrusion die compressible in response to changes in pressure of the coating material applied to the wire strand.

✦ ✦ ✦

No. 2,341,474, WIRE DRAWING AND COILING MACHINE, patented February 8, 1944 by Carroll E. Orr, Orange N. J., assignor to Syncro Machine Company, Rahway, N. J., a corporation of New Jersey.

One of the features of the machine are coating devices adapted to prevent breakage of the wire due to kinking.

✦ ✦ ✦

No. 2,341,513, PROCESS OF COATING METALLIC ARTICLES, patented February 15, 1944 by Marcella R. Gilbert, Los Angeles, Calif.

Consists in applying to the surface of the article to be coated a layer of coating material of the group consisting of raw beef suet and the glycerol esters of oleic, lineoleic or palmitic acid; and then heating the article to a temperature exceeding the melting point of the ester and maintaining this temperature for a time exceeding five minutes.

✦ ✦ ✦

No. 2,341,650, TOROIDAL COIL WINDING MACHINE, patented February 15, 1944 by Amos L. Quinlan, La Grange Park, Ill., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

This machine includes a movable core support, a core, device for winding wire thereon, means for moving the core support in one direction relative to the device to lay the wire evenly and means for simultaneously imparting an oscillatory movement to the core to apply the strand material to the core in successive layers disposed obliquely with respect to the axis of the core.

✦ ✦ ✦

No. 2,341,707, WIRE SUPPLY MECHANISM, patented February 15, 1944 by Charles W. Fornwald, Jr., Linden, N. J., assignor to Syncro Machine Company, Rahway, N. J., a corporation of New Jersey.

A rotatable wire carrier is provided to receive a number of convolutions of the wire the number being rendered constant by other portions of the mechanism. There are 14 claims.

✦ ✦ ✦

No. 2,341,712, METHOD OF MAKING CABLE, patented February 15, 1944 by Alvin N. Gray, Joppa, Md., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

Extruding a lead sheath around a cable core, thereafter cooling this lead sheath to about 100° F., and then directly passing the cooled lead sheathed cable through a brass plating bath to form a brass plate thereon as the cable moves continuously from the extruding operation.

✦ ✦ ✦

No. 2,341,731, WIRE COATING APPARATUS, patented February 15, 1944 by Basil N. MacGregor and Robert O. Scofield, Warren, Ohio, assignors to General Motors Corporation, Detroit, Mich., a corporation of Delaware.

The extrusion nozzle is heated by the same heating unit that heats the coating material passing therethrough.

✦ ✦ ✦

No. 2,341,916, WIRE FORMING METHOD AND DEVICE, patented February 15, 1944 by Veb Hansen, Brooklyn, N. Y., assignor of two-thirds to John N. Ledbetter, Jr., New York, N. Y.

This machine forms polygonal wire having a helical thread.

✦ ✦ ✦

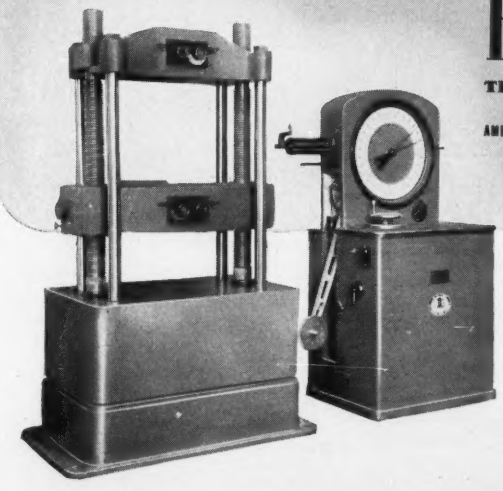
No. 2,342,388, SPRING CUSHION CONSTRUCTION, patented February 22, 1944 by Franklin O. Church, Buffalo, N. Y., assignor to Dunlop Tire and Rubber Corporation, Buffalo, N. Y., a corporation of New York.

(Please turn to Page 256)

PRECISION HYDRAULIC TESTING MACHINE with Pendulum Load Indication

MORE ACCURATE, MORE DEPENDABLE FOR PRODUCTION TESTING because:

Pendulum load indicator operates on the natural laws of gravitation. ...This principle of operation is not affected by temperature changes or subject to metal fatigue....*Write for descriptive literature and quotations.*

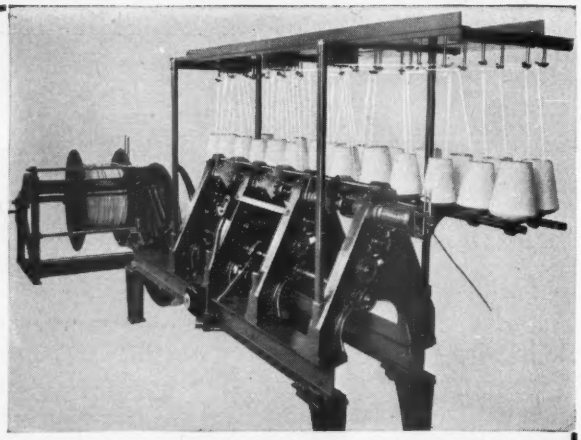


RIEHLE
TESTING MACHINES
Division of
AMERICAN MACHINE AND METALS, INC.
East Moline, Illinois

Other Products: IMPACT TESTERS · VICKERS HARDNESS MACHINES · BRINELL HARDNESS TESTERS · MEASURING INSTRUMENTS

FIDELITY
SINFRA
MULTIPLE-HEAD
HIGH-SPEED
COVERING
MACHINES

• • •

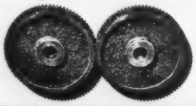


Knits two or three cotton coverings on bare wire up to #6 gauge—also flat or shaped, continuous-strip material, 1200 to 1500 feet per hour. Saves rubber since cotton coverings, impregnated, form excellent insulation. Straightening rollers operate horizontally and vertically. Each head knits one cover. 20″ or 36″ capstan take-off—separate haul-off reel stand, 40″ O.D., with traverse mechanism, 1000 lb. capacity.

Other advantages include: automatic electric stop motion on each yarn; improved knitting head and needle design; knits direct from large cones; quiet operation reduces operator fatigue.

Available in double- and triple-head types. Write for Bulletin.

Designers and Builders of Intricate, Automatic Precision Machines

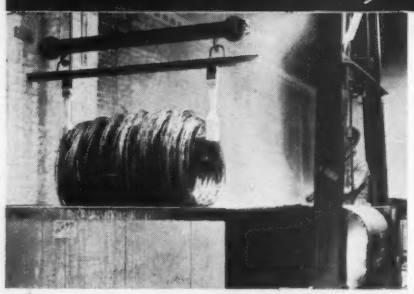


32 YEARS' EXPERIENCE

FIDELITY MACHINE COMPANY

3908-18 FRANKFORD AVENUE, PHILADELPHIA 24, PA.

MORRISON FLASH BAKERS



Save Time

Cut Costs

Speed Production

Fifty-three Morrison Flash Bakers now in operation in 29 plants are proving to wire manufacturers that their cost is an investment that pays dividends because of these operational features—

1—Space saving—size of a lime tank

2—Fit straight line or circle setups

3—Reduce cleaning house fog

4—Rust-free rod

5—High capacity

6—Acid brittleness recovery of about 95%

7—Rod remains on hook

8—Only a few minutes required for baking even fine wire

Descriptive Literature Sent on Request

MORRISON ENGINEERED

MORRISON ENGINEERING CORPORATION
5005 EUCLID AVENUE • • CLEVELAND, OHIO

Associate Companies: MORRISON ENGINEERING OF CANADA, LTD. TORONTO, ONTARIO — CARRIER ENGINEERING CO., LTD. LONDON, ENGLAND

A Review of Recent Wire Patents

(Continued from page 255)

A cap-like covering for the helical wire coils and border wire is included, consisting of a layer of cellular rubber.

✦ ✦ ✦

No. 2,342,736, RADIO CABLE, patented February 29, 1944 by Robert Herzog, Alfred Wiessner, and Rudolf Hintze, Berlin, and Fritz Gutzmann, Schoneiche, near Berlin, Germany; vested in the Alien Property Custodian.

There is a central wire conductor and an outer conductor concentric thereabout, the conductors being made of conducting strands interleaved in right and left hand lays, the strands of the outer conductor being of greater thickness than those of the inner conductor, and each of said conductors having the same limiting frequency, this limiting frequency being a multiple of the highest working frequency.

✦ ✦ ✦

No. 2,342,817, SCREW-THREADING MACHINE, patented February 29, 1944 by Werner Plagemann and Wilhelm Wemhoner, Berlin, Germany; vested in the Alien Property Custodian.

In each of the rollers dies having two axially spaced threaded portions and a non-threaded portion of reduced diameter between these threaded portions, and blank supporting means comprising a grooved member mounted between the reduced portions of the dies, in which only the middle portion of the blank is slidably carried, and adapted to hold the blank in position between the said dies while the sets of co-operating adjacent threaded portions simultaneously complete two threads on opposite ends of the bank, respectively.

✦ ✦ ✦

No. 2,342,999, LAYER FOR MAKING WIRE CORD, patented February 29, 1944 by Carl R. Brownell, Worcester, Mass.

The respective twist of the strands and the lay of the cord can be varied at will to produce a variety of cords differing as to strand twist and cord lay characteristics. There are 10 claims.

✦ ✦ ✦

Archie Chandler, Vice President, American Pulley Co., Retires As Sales Manager

ARCHIE CHANDLER, vice president of American Pulley Co., Philadelphia, has retired from active sales management of the company. Mr. Chandler will continue as vice president, but will return to San Francisco, where he will direct the company's sales and service on the West Coast. **Frank E. Brown** for 15 years assistant sales manager has been named his successor.

Ralph K. Clifford, Vice President and General Manager, Continental Steel Corp., Kokomo, Ind.

AT the regular monthly meeting of the Board of Directors of Continental Steel Corporation held March 24 following the annual stockholders' meeting, **Mr. Ralph K. Clifford** was elected Vice President and General Manager. Mr. Clifford began his career with the Kokomo Steel & Wire Company in 1907. In 1916, after graduating from the University of Michigan, he was named chief chemist at the Kokomo plant and in 1925, general superintendent.

✦ ✦ ✦

IN 1937 he became works manager of Continental Steel Corporation at Kokomo and in 1940 he was elected Vice President in Charge of Operations. He became a director of the corporation in 1941 and a member of the executive committee in 1943.

✦ ✦ ✦

MR. CLIFFORD is a past president and an active member of the Board of Directors of the Wire Association.

✦ ✦ ✦

MEMBERS of the Executive Committee are: Mr. Williams, chairman; Mr. Becker and Mr. Clifford.

APEX "PIC-KLEEN" PERFORMANCE DATA

(Case #5)

Type of Wire: 18-8 Stainless Steel
Speed: 1000 ft./min.
Reduction: 75%. From .110 to .055
No. of Holes: 5
Drawn: Dry

Results: Upon examination there was found to be still sufficient "PIC-KLEEN" coating on the wire to draw it an additional hole or two.

Conclusion: APEX "PIC-KLEEN" COATING COMPOUND can do for you, in your Mill, just what it has done in many other wire Mills, and on all types of Wire.
A trial will convince you.

APEX ALKALI PRODUCTS COMPANY

MAIN AND RECTOR STREETS
PHILADELPHIA 27 PENNSYLVANIA

BOSTON, MASS. PITTSBURGH, PA. ATLANTA, GEORGIA
MERIDEN, CONN. DETROIT, MICHIGAN LOS ANGELES, CALIF.

WILLEY'S DIES LAST MUCH LONGER

WILLEY'S TIPPED SHELL REAMERS

WRITE TODAY
For
WILLEY'S CATALOG

Contains full information about WILLEY'S METAL, standard cutting tools, special tools and gages, extrusion and wire drawing dies, centerless grinder blades and tungsten carbide grinders.

Let Willey's engineers design and build special cutting tools to fit your individual needs and machining operations. Tools "Tipped by Willey's" offer you definite price and production advantages. Good delivery. Send us your prints for quotation and delivery date.

And Remember
WILLEY'S DIES

We are now able to give excellent service and prompt delivery of

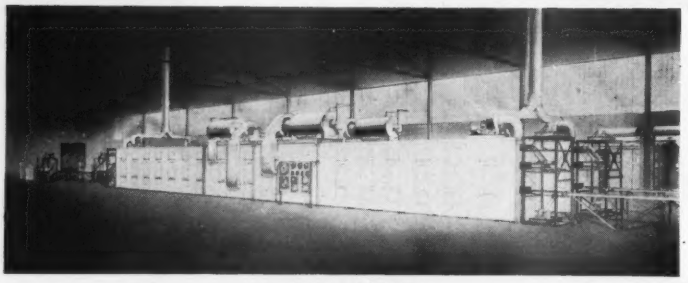
SMALL AMMUNITION DIES
WIRE DRAWING DIES
HEADING DIES
SHAPED DIES, TO YOUR SPECIFICATIONS

WILLEY'S CARBIDE TOOL CO.
SOLE MAKERS OF WILLEY'S METAL
1342 W. Vernor Highway Detroit 1, Michigan

MORE PRODUCTION IN LESS TIME *with* CARL-MAYER FURNACES, OVENS

CARL-MAYER HI-SPEED ROD BAKER

The fastest rod baker built! Saves up to 50% in time and fuel. Patented Blow-Off Feature removes moisture without bumping or agitating the coils. **Patented and patents pending.**



WELDING ROD OVEN

For drying coated welding rods. Uses the "Mayer" Recirculating Gas Fired Air Heater principle and Rod Transfer Systems (patents pending).

Growing interest in our type of equipment is evidenced by Carl-Mayer installations in such plants as:—

Atlantic Wire Co. · Atlas Steel Co. · Eaton Mfg. Co. · Hollup Corp. · Johnson & Nephew Ltd. · Page Steel & Wire Co. · Pittsburgh Tool Steel Wire Co. · Steel Co. of Canada · Wickwire Spencer Steel Co.

WRITE FOR BULLETIN #241

THE CARL-MAYER CORPORATION 3030 EUCLID AVENUE CLEVELAND, OHIO

CALLITE Phosphor Bronze Spring Wire, destined for use in delicate war instruments, gets a tough work-out at the Standard Spring and Manufacturing Company of Brooklyn. Here it is subjected to severe tests for fatigue and corrosion resistance, and precision to size.

THE UNIFORM EXCELLENCE of Callite Fine Wire is not accidental. It results from careful supervision of metals and processing by experienced men. Our metallurgists and engineers will gladly advise on wire types and their applications. Callite Tungsten Corporation, 572 Thirty-ninth Street, Union City, N. J. Branch Offices: Chicago, Cleveland.

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ARMY E NAVY CALLITE TUNGSTEN CORPORATION CT

Callite fine wires

Maximum Sales Prices for Wire and Cable

THE maximum price for sales of wire, cable, and cable accessories by wholesalers and jobbers, to industrial, commercial and governmental purchasers has been limited to 120 per cent of the manufacturer's net price to wholesalers in the same quantities. The limitation applies regardless of the number of sellers handling the product before it reaches the user.

✦ ✦ ✦

THIS action, effective March 21 1944, was taken by OPA to stop pyramiding of distributors' mark-ups—a practice which has arisen in the industry since the war emergency. Formerly, it was possible for each seller to add to his price "average percentage margins over net invoice cost." Former retailers had ranged into the wholesale field, and some wholesalers sold to each other, with each taking his full mark-up. In one case, four wholesalers handled a transaction, and the final price rose to 100 per cent above the manufacturer's price to the original wholesaler.

✦ ✦ ✦

THERE are some cases where wholesalers are directed by the War Production Board to purchase available stocks of wire, cable, and cable accessories from sources other than the manufacturer. If, in these and comparable situations, the new ceiling inflicts unreasonable hardship, relief may be granted upon individual application for adjustment, OPA said.

✦ ✦ ✦

American Wire Fabrics Elects Weaver Vice President

AT a meeting in March of the Board of Directors of the American Wire Fabrics Corporation, **Mr. B. L. Weaver** was elected a Vice President. The American Wire Fabrics Corporation, a subsidiary of the Wickwire Spencer Steel Company is said to have the largest capacity for the production of wire screen cloth and fabric in the world.

Wire-Drawing in Scotland
The Position Today

IN a recent letter to one of our English correspondents we commented on some old type wire drawing machines still in use in the United States and requested some data on the present position of the wire drawing industry in Scotland. The reply from our correspondent is quite informative and is quoted in full.

✦ ✦ ✦

"MY principal was very interested in the remarks re machines still in use in the U. S. A. which were developed in Scotland.

✦ ✦ ✦

LIKE many other things in the world of mechanics further progress was allowed to lapse, and no wire-drawing machinery is today manufactured in Scotland! English, Swedish, German and a few American machines being in general use.

✦ ✦ ✦

DURING the past few years, English machines have pretty well monopolised the Scottish market, proving superior to most foreign makes, with the possible exception of the German "Kratos" fine wire machines.

✦ ✦ ✦

THE war however has enabled the English designers to develop types even superior to these, and post war demands will be met by these and even better machines.

✦ ✦ ✦

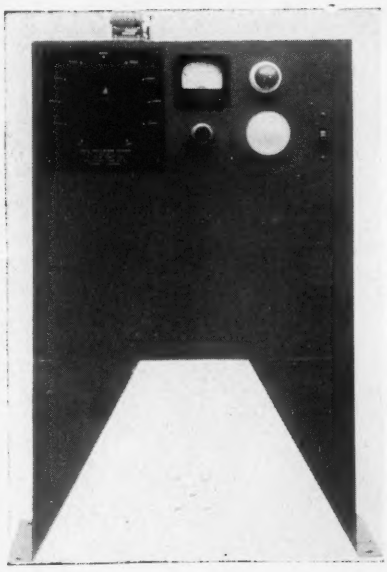
VERY little non-ferrous wire is drawn in Scotland at the present time, only one firm, as far as I am aware, is drawing all sizes from ¼ in. and 5/16 in. included.

✦ ✦ ✦

SEVERAL wire-weaving firms draw their own ferrous and non-ferrous wire, but only from sizes round about 0.036 in. the wire being bought in at that gauge.

(Please turn to Page 260)

SPARKER for SYNTHETIC EXTRUSION COMPOUNDS



THIS APPARATUS WILL LOCATE DIELECTRIC FAULTS while the wire is being insulated. When breakdown occurs, the operator is notified by an audible alarm. A resettable counter gives the number of faults in each reel. By sorting out the defective reels in this operation, the majority of the resparking is eliminated. Continuous range of voltage at the electrode is from one thousand to sixteen thousand volts. The sparker is equipped with voltmeter reading in kilovolts, and automatic interlock with the takeup motor.

R. L. Davis Electric Co.
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Higher and more uniform physical and fatigue properties.

No surface decarburization or scale. Faster wire speeds . . . greater production.

Equipment fully automatic and easy to operate.

Control of heating and cooling cycles extremely accurate.

Thermal efficiency of the process very high.

Much finer grained structure possible.

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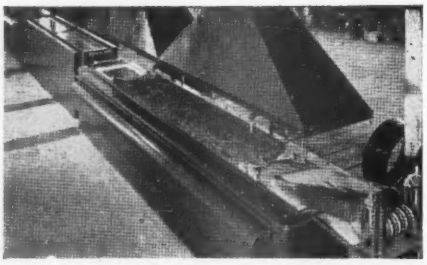
Adaptable to high alloy and austenitic steel wire and strip (annealing of stainless).



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The Trauwood Process, new in principle, eliminates high temperature furnaces and lead pots with their excessive maintenance costs and low thermal efficiencies. More positive temperature control is possible and quenching is done in a RISING temperature—instead of falling, as in conventional heat treating methods. The rapid rate of heating (4 to 5 times as fast as furnace heating) increases production and uniformly produces a finer grained product with higher physical and fatigue values.

Wire and rod patented by the Trauwood Process insures easier drafting and makes heavier reductions possible. In conjunction with the Trauwood patenting equipment, pickling, coating and baking can be made continuous, eliminating expensive handling and delay, materially reducing costs as compared with ordinary methods.

Complete details of the Trauwood Process will be furnished you on request. Our engineers will help you solve your continuous wire and strip patenting, tempering, and annealing problems. Write today.

THE TRAUWOOD ENGINEERING COMPANY

1740 E. 23rd STREET, CLEVELAND, OHIO, U.S.A.

Wire Drawing in Scotland

(Continued from Page 259)

THERE are, however, several wire-rope manufacturers who draw their own steel and iron wires from rod, also one or two galvanisers.

✦ ✦ ✦

ONE firm in particular, manufacturers of piano and high-tensile steel wire, is world famous.

✦ ✦ ✦

IN general, wire-drawing in Scotland is at a pretty low ebb, and shows little signs of any great development or progressive effort, much of the plant being well behind modern ideas.

✦ ✦ ✦

WITH the possible exception of those mentioned, few firms possess modern tool equipment, such as hard-metal and diamond die drilling and polishing machines, or modern high-speed wire-drawing plant.

✦ ✦ ✦

POSSIBLY post-war demands and opportunities will open their eyes to enable them to develop an industry which is well worthy of any skill and energy put into it, also to abandon the method of introducing any casual labour into the trade, and train and develop their own personnel along proper lines making it worth while.

✦ ✦ ✦

THESE remarks apply in particular to the ferrous metal section of the industry, as it is in this branch that greater scope is given to the new-comer, especially in the development of new alloys and new technique in galvanising, also in the use of hard metal and diamond tools.

✦ ✦ ✦

IF the industry is to obtain a firm foothold in Scotland and face up to intense home and foreign competition, more modern method and greater collaboration with wire-drawing plant designers will have to be adopted. A smattering of knowledge in metallurgy will be of great assistance to future entrees

into the industry, and facilities to obtain the necessary information should be provided by employers with an eye to building up an efficient and interested staff.

✦ ✦ ✦

FREE access to any technical literature or trade journals should be made available and advantage taken of the expert advice so freely offered. If the lessons learned during the depressing years following the last war are to make any impression at all, the trades conservative and parish pump outlook will have to be radically altered.

✦ ✦ ✦

THE importance of an efficient die room must be realised.

✦ ✦ ✦

RUN on methodical lines and under the supervision of an expert in the treatment and use of hard-metal and diamond dies greater output and superior quality wire will be the natural outcome.

✦ ✦ ✦

THIS department has too long been the Cinderella of the trade, and the high returns from a modern lay out run in the right lines, capable of handling the exacting requirements of modern wire-drawing machinery and plant, are still not sufficiently realised by a good many firms. The training of die polishers and repairers should also be treated with the importance it deserves.

✦ ✦ ✦

YOUNG persons beginning in the die room should also be given time and actual experience in the wire-mill, a greater realisation of the requirements and practical use of dies being gained by this method. Probably our American friends will be somewhat surprised to hear about the position in this country and the long silence now broken may cause some comment.

✦ ✦ ✦

THE policy of hush-hush and jealously guarded secrets is, however, common in the trade and in the writer's opinion is detrimental to the industry as a whole."

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NO DIES!
SHEAR
"DIE-LESS" DUPLICATING
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might be described as a new industrial technique made possible by the accuracy, extreme adaptability and ease of operation of DI-ACRO Precision Machines—Shears, Brakes, Benders—when used as a continuous, integrated production process.
The DI-ACRO System of METAL DUPLICATING WITHOUT DIES has proven its adaptability in making parts just as accurately as can be done with dies, to a tolerance of .001" in all duplicated work. The delay of waiting for dies is avoided, deliveries speeded up.
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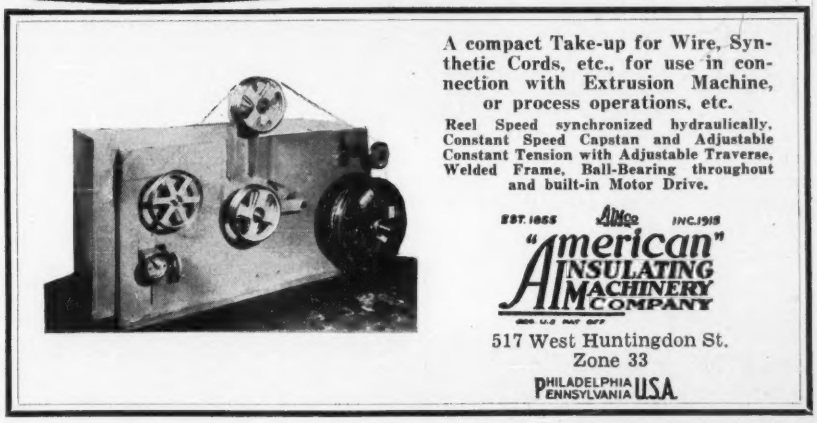
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Roos Company Expands

ONE of the largest and oldest manufacturers of wire drawing die machinery, **Roos Tool & Mfg. Co.**, formerly of Bloomfield, N. J., is now located in their new modern plant at 17-19 Grove Street, Montclair, N. J. The new two-story factory with 11,000 square feet of floor space adjoins the Delaware, Lackawanna and Western Railroad terminal in Montclair.

✦ ✦ ✦

RECENTLY elected officers are **J. Gordon Kaveny**, President; **G. T. Petersen**, Secretary and Plant Superintendent; and **Gideon Roos**, Vice-President. The company manufactures a complete line of wire drawing die machinery, light and heavy duty lapping machines, drillers, grinders and polishing lathes.

✦ ✦ ✦

IN addition to supplying standard equipment, a highly skilled and experienced engineering staff is available for consultation to manufacturers faced with some unusual problem.

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FOR SHIPPING
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Last Longer

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Smooth inner surfaces, much greater strength with the absence of all cutting or abrading projections — these protect not only the cable but the men handling it.

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Appreciably lighter than wooden reels — cost less to ship — a cumulative saving that more than offsets increased first cost.

Reduce Investment

The longer life of R. B. Hayward Steel reels reduces the investment in reel equipment.

Write for description of construction and prices.

R. B. HAYWARD CO.

1714 Sheffield Ave.

Chicago, Illinois

Decarburization Control with Nitrogen Gas

(Continued from Page 237)

THE furnace was well purged before it was lighted; as the data table and equilibrium chart indicate, the dew point of the gas was -29°C. As the equilibrium chart indicates, a reaction was formed immediately upon lighting the furnace. This reaction reached its peak at about the six hour point. After being held at the temperature of 1000°F. for four hours, the CO_2:CO ratio was .53, which is considered heavily decarburizing.

✦ ✦ ✦

THE charge was held at 1000°F. for a period of almost 22 hours, in an attempt to complete reactions and rid the furnace of decarburizing constituents.

✦ ✦ ✦

IT may also be noted that, at the 6 hour heating period, the dew point of the gas had risen from -29°C to plus 9°C or from .042% to .942% H_2O vapor content, a very moist condition.

✦ ✦ ✦

AT the end of the 22 hour holding period, the furnace temperature control was set at 1300°F, and when the charge reached that point, strong reactions reappeared; 0.8% CO_2 was formed, but the CO content, unlike those of the previous reactions, had increased, instead of decreasing to enter into combination with some other component gas. The CO content of the entering gas was 2.5%, that of the discharged gas was 2.7%. This indicates that the CO_2 was reacting and possibly the carbon of the steel, which might be illustrated by the equation:—

$$C + CO_2 \rightleftarrows 2CO$$
$$FeC + CO_2 \rightleftarrows Fe + 2CO$$

✦ ✦ ✦

SINCE the H_2O had not reacted at this point, either of the above reactions may have taken place.

BELL-MINE LIME

FOUNDED 1879 Warner SAND-GRAVEL LIME PRODUCTS

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There is a standard Porter tool for every cutting job up to ¾" annealed bolts or ½" hardened chains. Special cutters designed to fit your industry's needs.

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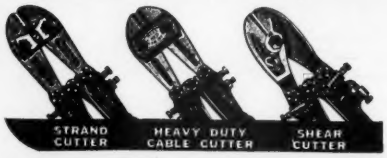

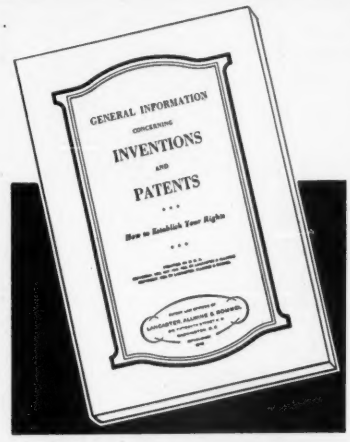

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BY the end of the 33 hour period, and after the soaking part of the cycle, the reactions had completed themselves, and the action of the gas became neutral. From this point to the end of the cycle, no further reactions are indicated.

✦ ✦ ✦

THE decarburization results in this charge, as the data table indicates, were very poor, and the charge was rather badly decarburized. Both the depth and the nature of the decarburization increased.

✦ ✦ ✦

IN decarburization of this nature, the carbon loss in percentage of carbon content at the surface, if tested by means of chemical analysis, would be very high.

✦ ✦ ✦

MAY it be pointed out that, in charges #1 and #4, where decarburizing reactions took place with no decarburization of the steel, the period of exposure to these reactions was very short. If we consider .2 as a safe CO_2:CO ratio for short periods, the periods during which charges #1, #4 and #5 were exposed to a higher CO_2:CO ratio, may be compared as follows:

Charge #1— 3¼ hours
Charge #4— 1½ hours
Charge #5—10¼ hours

✦ ✦ ✦

IT can plainly be seen from this comparison that decarburization will take place if the period of exposure to decarburizing gases is long and yet no decarburization takes place if the charge is exposed to the same type of gas for only a short period of time.

✦ ✦ ✦

ALTHOUGH the furnace in which this charge was annealed could be considered as gas tight, and a positive internal atmosphere pressure of 0.5" W.C. was maintained, it was not quite as tight or leak proof as an inner cover. It is possible that the radiant tubes could contain small pin holes at the welded joints, through which the

(Please turn to Page 264)

Easy Way to Reduce Wire Baking Time!

If you want to facilitate your production of wire...materially reduce baking time...treat steel rods after pickling with Oakite Composition No. 24.

You will find this specialized material lessens acid embrittlement by completely, rapidly, neutralizing steel surfaces. This shortens baking time . . . helps you secure greater tonnage. Your nearby Oakite Technical Service Representative will gladly give you full details. Write TODAY . . . there's no obligation!

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APEX "DRAW-ALLOY" PERFORMANCE DATA

(Case #52)

Type of Wire: Copper-nickel alloy.
Speed: 2200 ft./min.
Reduction: .025 to .0063.
No. of Dies: 12
Drawn: Wet
Dies: Diamond
Results: Production figures on the finishing die jumped from a two-numbered figure to several thousand, through the use of Apex "Draw-Alloy". Quoting the wire-mill supt. verbatim: "We are obtaining unheard of results with Apex 'Draw-Alloy'."
Conclusion: A test-run of Apex "Draw-Alloy" in your mill will prove its worth on *all* nickel-alloy wires. Please write.

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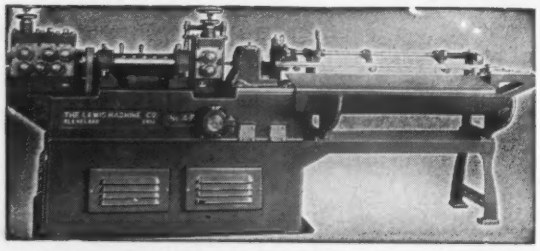

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WE CAN SUPPLY AND ENGINEER OUR TOOLS EQUIPPED WITH CARBOLOY CEMENTED CARBIDE

THE LEWIS MACHINE CO., 3445 E. 76 St., Cleveland, Ohio

Decarburization Control with Nitrogen Gas

(Continued from Page 263)

CO_2 and H_2O vapor could enter the furnace and form a decarburizing atmosphere. This seems very probable, as each time the furnace temperature was increased and the burners opened up, an increase in CO_2 and H_2O was observed. There is also a possibility, in furnaces of this type, when used without an inner cover, for the reducing components CO and H_2 to react with any iron oxides that may be contained in the exposed refractory materials.

✦ ✦ ✦

WHILE the primary purpose of this paper is to present the description, application and functions of this type of nitrogen gas atmosphere equipment used to prevent decarburization in annealing, the technical theories and explanations were covered for the benefit of those who may be interested in the chemistry of such gaseous reactions. In order to further illustrate these reactions and gas equilibrium in the furnaces throughout the entire annealing cycle, the gas equilibrium chart and data table for each charge, as actually run, is presented.

✦ ✦ ✦

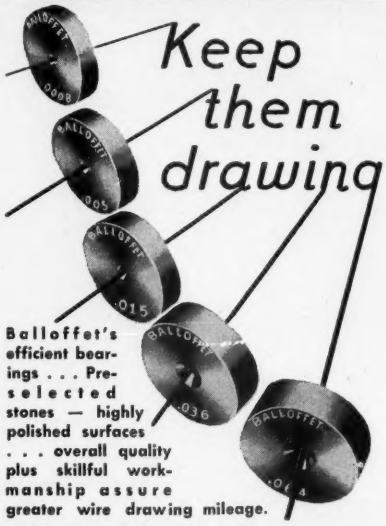
THE practice of analyzing the discharged atmosphere gas as a means of determining what reactions take place, and whether the atmosphere is at equilibrium, is of extreme value as an operation guide. The analysis of these discharged gases will indicate what results in decarburization control can be expected, even before the cycle is completed, and can prevent serious losses of valuable alloys steels.

✦ ✦ ✦

New Catalog Presents Full Line of Clark Tructractor

PROFUSELY illustrated and carrying specification data on every model of Clark Tructractor, this new VEST POCKET CATALOG has just been released for distribution by Clark Tructractor Division of Clark Equipment Company, Battle Creek, Michigan.

Balloffet
DIAMOND DIES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Norton Company Makes Appointments

PHILIP H. CLAPP has been appointed abrasive division district manager for the Pacific Coast by Norton Company, Worcester, Massachusetts. He will make his headquarters in Los Angeles. Mr. Clapp has been with Norton Company for thirty years and since 1935 has been abrasive division district manager in Detroit. Previous to that he was for many years the Norton abrasive engineer in the California area.

+ + +

DONALD L. PRICE has been appointed abrasive division district manager in Detroit succeeding Mr. Clapp. Mr. Price has been with Norton Company for twenty-four years and since 1926 has been located in the Detroit district as field engineer and abrasive engineer.

+ + +

H. M. Harper Company Appoints Representative

MR. HARRIS B. CARLOCK, 1329 North Highland Avenue, N. E. Atlanta, Georgia, has been appointed to represent the H. M. Harper Company in Tennessee, Mississippi, Alabama, Georgia, North Carolina and South Carolina. He will handle the entire line of Harper non-ferrous and stainless bolts, nuts, screws, washers and other fastenings.

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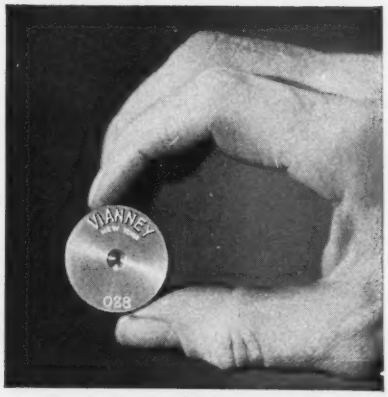
Famous Wire Drawing Diamond Dies



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REVERE Copper & Brass, Inc., 230 Park Ave., New York, N. Y., has just issued their 1944 catalog, containing new technical information on alloys and manufactured forms. This embodies graphic charts showing physical properties, general and working properties, A. S. T. M. specifications and typical uses and applications. Besides this there are descriptions of the manufactured forms available and a special section covering the techniques for welding non-ferrous alloys and for the bronze welding of ferrous metals.

✦ ✦ ✦

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THE Western Electric Company has leased Area 2 of the Eau Claire Ordnance Plant at Eau Claire, Wisconsin, formerly engaged in arms production.

✦ ✦ ✦

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New Furnace Catalog for Small Parts Heat Treatment

ANYONE who has a problem involving the heat-treatment of tools, dies or small production parts, and doesn't have recent literature on Vapocarb-Hump furnace equipment, may be interested in a 36-page catalog just issued by Leeds & Northrup Company. Although the text of this revised catalog is essentially the same as the preceding 1940 edition, there are numerous new illustrations of recent installations.

\+ + +

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Index To Advertisers

A

Ajax Industrial Supplies, Inc. 265
American Chemical Paint Co. 221
American Insulating Machinery Co. 261
Apco Mossberg Co. 267
Apex Alkali Products Co. 257-263

B

Balloffet Dies & Nozzle Co., Inc. 265
Bethlehem Steel Co. 210
Bick, Hans C., Inc. 266
Brewer Mfg. Co. 266
Broden Construction Co., The 253

C

Callite Tungsten Corp. 258
Carboloy Company, Inc. Insert-240-B-C
Carl-Mayer Corp., The 258
Ceilcote Company, The 262
Cleveland Tramrail Div. of Cleveland Engineering Co. 267
Cochaud Wire Die Corp. 265
Continental Steel Corp. 264
Cook Engineering Co. 264
Crepe-Kraft Co., The 267

D

Davis, R. L., Electric Co. 259
Durant Mfg. Co. 267

E

Electric Furnace Company Back Cover
Emory, Robert J., Co. 267

F

Fidelity Machine Co. 256
Firth-Sterling Steel Co. 226
Fort Wayne Wire Die, Inc. 265

G

Gilron Products Co., Inc. 259
Glader, Wm., Machine Works 254

H

Hartley, Geo. D. 266
Haveg Corp. 267
Hayward Co., The R. B. 262
Hubbard Spool Company 249
Hudson Wire Co. Inside Back Cover

I

Indiana Wire Die Co. 265
Industrial Oven Eng. Co. 251

J

Jersey Steel & Wire Corp. 266
Jones & Laughlin Steel Corp. 216

K

Keagler Brick Co. 267
Kelly Wire Die Corp. 265
Keystone Steel & Wire Co. 246

L

Lancaster, Allwine & Rommel 263
Lewis, K. B. 266
Lewis Machine Co., The 264
Luginbill Wire Die Co. 265
Lyon-Vail Machine Co., Inc. 267

M

Magnus Chemical Co. 211
Michigan Wire Die Co. 265
Micro Products Co. 242
Morgan Construction Co. 224
Morrison Engr. Corp. 256
Moslo Machinery Co. 267
Mossberg Pressed Steel Corp. 247

N

National Annealing Box Co. 267
National Machinery Exchange 266
New England Butt Co. 267
Nilson, A. H., Machine Co. 260
Norton Company 209
Nukem Products Co. 267

O

Oakite Products, Inc. 263
O'Neil-Irwin Mfg. Co. 261
Owens-Corning Fiberglas Corporation 217

P

Plastics Div. of Carbide and Chemical Corp. Insert-240-D
Platt Bros. & Co., The 266
Porter, H. K., Inc. 263

R

Riehle Testing Machines Div. of American Machine & Metals, Inc. 255
Robertson, John, Co., Inc. 214
Rockwell, W. S., Co. 267
Roebling's, John A. Sons, Company 245
Roos, H. & G., Tool & Mfg. Co. 264
Ross, J. O., Engineering Corp. 244
Royle, John, & Sons 219
Ruesch, H. J., Machine Co. 267
Rusch Wire Die Corp. 265

S

Sauereisen Cements Co. 267
Scott, Henry L., Co. 266
Scudder, E. J., Foundry & Machine Co. 267
Shell Oil Co. Insert-240-A
Sleeper & Hartley, Inc. 266
Standard Industrial Compounds Co. 213
Standard Machinery Company 220
Stevens Metal Products Co., The 225
Surface Combustion Div. of General Properties Co., Inc. 267
Syncro Machine Co. 215

T

Torrington Mfg. Co., The 266
Trauwood Engineering Co. 260
Tungsten Electric Corp. 248

V

Vascoloy-Ramet Corp. 222
Vaughn Machinery Co. Front Cover
Vianney Wire Die Works 265

W

Warner Company 262
Waterbury-Farrel Fdry. & Machine Co. 223
Watson Machine Co. 250
Wayne Wire Die Co. 265
Wickwire Spencer Steel Co. 212
Willey's Carbide Tool Co. 257
Wilson, Lee, Engr. Company Inside Front Cover
Wopis Industry Lab. 265

WHERE TO BUY

For more complete information, consult the annual Wire and Wire Products Directory, Index & Buyers' Guide.

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Norton Co., Worcester, Mass.

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American Chemical Paint Co., Ambler, Pa.
Parkin, Wm. M., Co., Pittsburgh, Pa.

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Syncro Machine Co., Rahway, N. J.

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Scudder, E. J., Foundry & Machine Co., Trenton, N. J.

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Syncro Machine Co., Rahway, N. J.
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BAKERS—Hi-Speed
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Morgan Construction Co., Worcester, Mass.
Morrison Engr. Corp., Cleveland, Ohio
Moslo Machinery Co., Cleveland, Ohio.
Ross, J. O., Engineering Corp., New York, N. Y.

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Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

BORON CARBIDE—
Norton Co., Worcester, Mass.

BRAKES & SHEARS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

BRICKS—Acid Proof
Keagler Brick Co., Steubenville, Ohio.

CABLE LACQUERING OVENS
Industrial Oven Engr. Co., Cleveland, Ohio.

CABLE—Steel and Copper
Brewer Mfg. Co., Muncy, Pa.

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Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.

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CEMENTS—Acid Proof
Sauereisen Cement Co., Pittsburgh, Pa.

CEMENTS—Refractory
Norton Co., Worcester, Mass.

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Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.
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Standard Industrial Compounds Co., Chicago, Ill.

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Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
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Standard Industrial Compounds Co., Chicago, Ill.

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Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.
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Wilson, Lee, Engr. Co., Cleveland, Ohio

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COMPOUNDS—Metal Finishing
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COMPOUNDS—Rust Preventing
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COMPOUNDS—Rust Removing
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Apex Alkali Products Co., Philadelphia, Pa.

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Standard Industrial Compounds Co., Chicago, Ill.

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Vascoloy-Ramet Corp., North Chicago, Ill.

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Callite Tungsten Corp., Union City, N. J.
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Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Wks., New York, N. Y.

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Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

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Kelly Wire Die Corp., New York, N. Y.
Luginbill Wire Die Co., Fort Wayne, Ind.
Rusch Wire Die Corp., New York, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

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Firth-Sterling Steel Co., McKeesport, Pa.
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Rusch Wire Die Corp., New York, N. Y.
Tungsten Electric Corp., Union City, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

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Firth-Sterling Steel Co., McKeesport, Pa.
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Rusch Wire Die Corp., New York, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
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Firth-Sterling Steel Co., McKeesport, Pa.
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Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., New York, N. Y.
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Standard Machinery Co., Providence, R. I.
Vaughn Machinery Co., Cuyahoga Falls, O.

DRUMS—Flange Steel
Stevens Metal Products Co., Niles, O.

DRUMS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

DRYING AND PRE-HEATING ROOMS—
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DRYING EQUIPMENT—
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ENGINEERS—Consulting Wire Mill
Hartley, George D., Worcester, Mass.
Lewis, Kenneth B., Worcester, Mass.

EQUIPMENT—Insulation Testing
Davis, R. L., Electric Co., Wallingford, Conn.

EYELETS—Brass or Zinc
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American Chemical Paint Co., Ambler, Pa.

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Electric Furnace Co., Salem, O.
Morrison Engr. Corp., Cleveland, Ohio
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Trauwood Engr. Company, Cleveland, Ohio
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Automatic
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Morrison Engr. Corp., Cleveland, Ohio
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Brazing
Electric Furnace Co., Salem, O.
Firth-Sterling Steel Co., McKeesport, Pa.

WHERE TO BUY, Continued

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Wilson, Lee, Engr. Co., Cleveland, Ohio

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Trauwood Engr. Co., Cleveland, Ohio

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Carl-Mayer Corp., The, Cleveland, Ohio
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Morrison Engr. Corp., Cleveland, Ohio
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio
Trauwood Engr. Co., Cleveland, Ohio

FURNACES—Lead Melting
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Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio

FURNACES—Non-Oxidizing
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Morrison Engr. Corp., Cleveland, Ohio
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio

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Carl-Mayer Corp., The, Cleveland, Ohio
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Morrison Engr. Corp., Cleveland, Ohio
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.

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Electric Furnace Co., Salem, Ohio
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.

FURNACES—Wire, Strip & Sheet
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Morrison Engr. Corp., Cleveland, Ohio
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio

GALVANIZING EQUIPMENT—
Wilson, Lee, Engr. Co., Cleveland, Ohio

GALVANIZING KETTLES—
National Annealing Box Co., Washington, Penna.

GLASS YARN—For Insulation
Owens-Corning Fiberglas Corp., Toledo, O.

GRINDERS—Roll
Norton Co., Worcester, Mass.

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HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

INHIBITORS—
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Apex Alkali Products Co., Philadelphia, Pa.

INSULATION LACQUERING SYSTEMS—Continuous
Industrial Oven Engr. Co., Cleveland, O.

INSULATING MATERIALS — For Electric Wire and Cable
Owens-Corning Fiberglas Corp., Toledo, O.
Carbide & Carbon Chemicals Corp., Plastics Div., New York, N. Y.

KETTLES—Galvanizing, Annealing, Tinning, etc.
National Annealing Box Co., Washington, Penna.

LATHES—Die Reaming
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Morgan Construction Co., Worcester, Mass.
Roos, H. & G., Tool & Mfg. Co., Montclair, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry & Machine Co., Waterbury, Conn.

LIME—
Warner Company, Philadelphia, Pa.

LININGS—Acid and Alkali Proof
Ceilcote Co., The, Cleveland, Ohio

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

LUBRICANTS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y. Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Robertson, John, Co., Brooklyn, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
Fidelity Machine Co., Philadelphia, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Brazing
Syncro Machine Co., Rahway, N. J.

MACHINERY—Bunching
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable, Electric
American Insulating Mach'y. Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Chain Making
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Closing
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Coilers
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
New England Butt Co., Providence, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Copper Wire Drawing and Rolling
American Insulating Machy. Co., Philadelphia, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire
American Insulating Machy. Co., Philadelphia, Pa.
Fidelity Machine Co., Philadelphia, Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Cutting
Broden Construction Co., Cleveland, Ohio
Lewis Machine Co., The, Cleveland, Ohio
Moslo Machinery Inc., Cleveland, Ohio.
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Porter, H. K., Inc., Everett, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Die Making
Firth-Sterling Steel Co., McKeesport, Pa.
Roos, H. & G., Tool & Mfg. Co., Montclair, N. J.

MACHINERY — Die Making for Forming Special Shapes
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

MACHINERY—Draw Benches
Broden Construction Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Edging
Broden Construction Co., Cleveland, Ohio.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Enameling
American Insulating Mach'y. Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Extruding
Robertson, John, Co., Brooklyn, N. Y.
Royle, John, & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Flat Wire
Broden Construction Co., Cleveland, Ohio
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Forming
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Galvanizing
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Galvanizing Wire
Broden Construction Co., Cleveland, O.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Gang Winders
Fidelity Machine Co., Philadelphia, Pa.
Robinson Mfg. Co., Muncy, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., Worcester, Mass.

MACHINERY—Hydraulic Test
Riehle Testing Machine Div. of American Machine and Metals, Inc., East Moline, Ill.

MACHINERY—Insulating
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Knitting
Fidelity Machine Co., Philadelphia, Pa.

MACHINERY—Lead Encasing Presses, etc.
Robertson, John, Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
Robertson, John, Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Material Handling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

WHERE TO BUY, Continued

MACHINERY — Measuring Wire & Cable
Davis, R. L., Electric Co., Wallingford, Conn.
Durant Mfg. Co., Milwaukee, Wis.
Lyon-Vail Machine Co., Brockton, Mass.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Broden Construction Co., Cleveland, Ohio.
Glader, Wm., Machine Works, Chicago, Ill.
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Panning
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Pointing
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Quill Winding
Fidelity Machine Co., Philadelphia, Pa.

MACHINERY—Rod Mill
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.

MACHINERY—Rolling Mill
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Rubber for Insulating Wire
Royle, John, & Sons, Paterson, N. J.

MACHINERY—Rubber Strip Covering
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Screw Wire
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, Ohio
Emory, Robert J., Co., Newark, N. J.
New England Butt Co., Providence, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I. (Special Designs)
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spooling
American Insulating Mach'y Co., Phila., Pa.
Emory, Robert J., Co., Newark, N. J.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spring Making
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Broden Construction Co., Cleveland, Ohio
Lewis Machine Co., The, Cleveland, Ohio
Moslo Machinery Co., Cleveland, Ohio
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Stranding
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Broden Construction Co., Cleveland, Ohio
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Swaging
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Testing
Riehle Testing Machine Div. of American Machine and Metals, Inc., East Moline, Ill.
Scott, Henry L., Co., Providence, R. I.

MACHINERY—Testing Size of Wire
Davis, R. L., Electric Co., Wallingford, Conn.

MACHINERY—Testing Spring
Standard Machinery Co., Providence, R. I.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Welding Wire
Micro Products Co., Chicago, Ill.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wind-up (Constant Tension, Variable Speed)
Industrial Oven Engr. Co., Cleveland, O.

MACHINERY—Wire Bending
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

MACHINERY—Wire Drawing
American Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Wire Measuring
Durant Mfg. Co., Milwaukee, Wis.
Lyon-Vail Machine Co., Inc., Brockton, Mass.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Tinning
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Wood Screw
National Machinery Exchange (Used), New York, N. Y.

MATERIAL HANDLING EQUIPMENT
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

MILLS—Tandem Rolling and Edging
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip
Hudson Wire Co., Ossining, N. Y.

OILS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Shell Oil Co., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

OVENS—Cable Lacquering
Industrial Oven Engr. Co., Cleveland, Ohio

OVENS—Dehydrogenizing
Industrial Oven Engr. Co., Cleveland, O.

OVENS—Industrial
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Oven Engr. Co., Cleveland, Ohio
Morrison Engr. Corp., Cleveland, Ohio
Ross, J. O., Engineering Corp., New York, N. Y.

OVENS—Welding Rod Coating
Industrial Oven Engr. Co., Cleveland, O.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.

PAINTS—Marine
American Chemical Paint Co., Ambler, Pa.

PAINTS—Structural Steel
American Chemical Paint Co., Ambler, Pa.

PANS—Lead and Spelter
National Annealing Box Co., Washington, Penna.

PANS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

PAPER—Creped Wrapping
Crepe-Kraft Co., Newark, N. J.

PAPER TESTERS—
Scott, Henry L., Co., Providence, R. I.

PATENT ATTORNEYS—
Lancaster, Allwine and Rommel, Washington, D. C.

PAY-OFF STAND—Constant Tension
Cook Engineering Co., Prospect Park, N. J.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

PICKLING TANK LININGS—
Ceilcote Co., The, Cleveland, O.
Keagler Brick Co., Steubenville, Ohio.
Sauereisen Cement Co., Pittsburgh, Pa.

PIPES AND FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

PLASTICS—For Insulation
Carbide & Carbon Chemicals Corp., Plastics Div., New York, N. Y.

PLASTIC TESTERS—
Scott, Henry L., Co., Providence, R. I.

POTS—Lacquer
Industrial Oven Engr. Co., Cleveland, O.

POTS—Lead Melting
Robertson, John, Co., Brooklyn, N. Y.

POWDER—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.

PRESSES—Hydraulic and Mechanical
Robertson, John, Co., Brooklyn, N. Y.
Standard Machinery Co., Providence, R. I. (Mechanical Only)

WHERE TO BUY, Continued

PRESSES—Lead
Robertson, John, Co., Brooklyn, N. Y.

PRESSURE VESSELS—
National Annealing Box Co., Washington, Penna.

PULLERS—Wire
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
Robertson, John, Co., Brooklyn, N. Y.

REEL AND TENSION STAND—
Fidelity Machine Co., Philadelphia, Pa.
Moslo Machinery Co., Cleveland, Ohio
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS—Annealing and Stranding
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REELS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REELS AND SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REELS—Takeoff
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REELS—Vulcanizing and Impregnating
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REELS—Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REFRACTORIES—High Temperature
Norton Co., Worcester, Mass.

ROD BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio
Morrison Engr. Corp., Cleveland, Ohio
Moslo Machinery Co., Cleveland, Ohio
Ross, J. O., Engineering Corp., New York, N. Y.

RODS—Wire—Non-Ferrous
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Wickwire Spencer Steel Co., New York, N. Y.

ROLL STRAIGHTENERS—
Moslo Machinery Co., Cleveland, Ohio

ROPE—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Brewer Mfg. Co., Muncy, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.

RUBBER AND RUBBER COMPRESSION TESTERS—
Scott, Henry L., Co., Providence, R. I.

RUST PROOF COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

RUST REMOVING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

SATURATION SYSTEMS—
Industrial Oven Engr. Co., Cleveland, O.

SHEARS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

SHEET—Steel
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.

SOAPS—Industrial and Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

SOLVENT RESIN SYSTEMS—Experimental
Industrial Oven Engr. Co., Cleveland, O.

SPOOLS—Annealing and Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

SPOOLS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

STAMPINGS—Steel
Hubbard Spool Co., Chicago, Ill
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRAND—Steel and Copper
Brewer Mfg. Co., Muncy, Pa.

STRIP—Brass and Non-Ferrous
Hudson Wire Co., Ossining, N. Y.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.

STRIP METAL TESTERS—
Scott, Henry L., Co., Providence, R. I.

SWIFTS—Take-off
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.

TANK LININGS—Brick
Ceilcote Co., The, Cleveland, O.
Keagler Brick Co., Steubenville, Ohio.
Nukem Products Corp., Buffalo, N. Y.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TANKS—Pickling
Haveg Corp., Newark, Del.
Nukem Products Corp., Buffalo, N. Y.
Sauereisen Cements Co., Pittsburgh, Pa.

TANKS—Steel
Mossberg Pressed Steel Corp., Attleboro, Mass.

TENSILE TESTERS—
Scott, Henry L., Co., Providence, R. I.

TESTING INSTRUMENTS—
Riehle Testing Machine Div. of American Machine and Metals, Inc., East Moline, Ill.
Scott, Henry L., Co., Providence, R. I.

TOOLS—Wire Cutting
Porter, H. K., Inc., Everett, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TREADS—Safety
Norton Co., Worcester, Mass.

TRUCKS—
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

TUBE BENDERS AND FORMERS—
Ruesch, H. J., Machine Co., Newark, N. J.

TURKS HEADS—Friction and Power Driven
Standard Machinery Co., Providence, R. I.

VALVES AND FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

VULCANIZERS—
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WELDERS—Spot and Butt
Micro Products Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio

WIND-UP AND UNWIND SYSTEMS—Continuous
Industrial Oven Engr. Co., Cleveland, O.

WIRE—Cold Heading
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.

WIRE—Electric
Hudson Wire Co., Ossining, N. Y.
Roebling's, John A., Sons Co., Trenton, N. J.

WIRE—Enameled for Coils
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Flat
Roebling's, John A., Sons Co., Trenton, N. J.

WIRE—Manufacturers
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Wickwire Spencer Steel Co., New York, N. Y.

WIRE—Music
Jersey Steel & Wire Corp., Irvington, N. J.

WIRE—Nickel Silver and Phosphor Bronze
Callite Tungsten Corp., Union City, N. J.
Hudson Wire Co., Ossining, N. Y.

WIRE—Non-Ferrous to Specification for Special Purposes
Callite Tungsten Corp., Union City, N. J.
Hudson Wire Co., Ossining, N. Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Spring
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.

WIRE—Stainless Steel
Callite Tungsten Corp., Union City, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.
Wickwire Spencer Steel Co., New York, N. Y.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's, John A., Sons Co., Trenton, N. J.
Wickwire Spencer Steel Co., New York, N. Y.

WIRE AND STRIP—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WIRE TESTERS—
Scott, Henry L., Co., Providence, R. I.

WIRE, WEAVING—Non-Ferrous
Hudson Wire Co., Ossining, N. Y.

WRAPPING PAPER—Creped
Crepe-Kraft Co., Newark, N. J.

YARN TESTERS—
Scott, Henry L., Co., Providence, R. I.

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TWISTED MULTIPLES
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SPECIALS TO ORDER

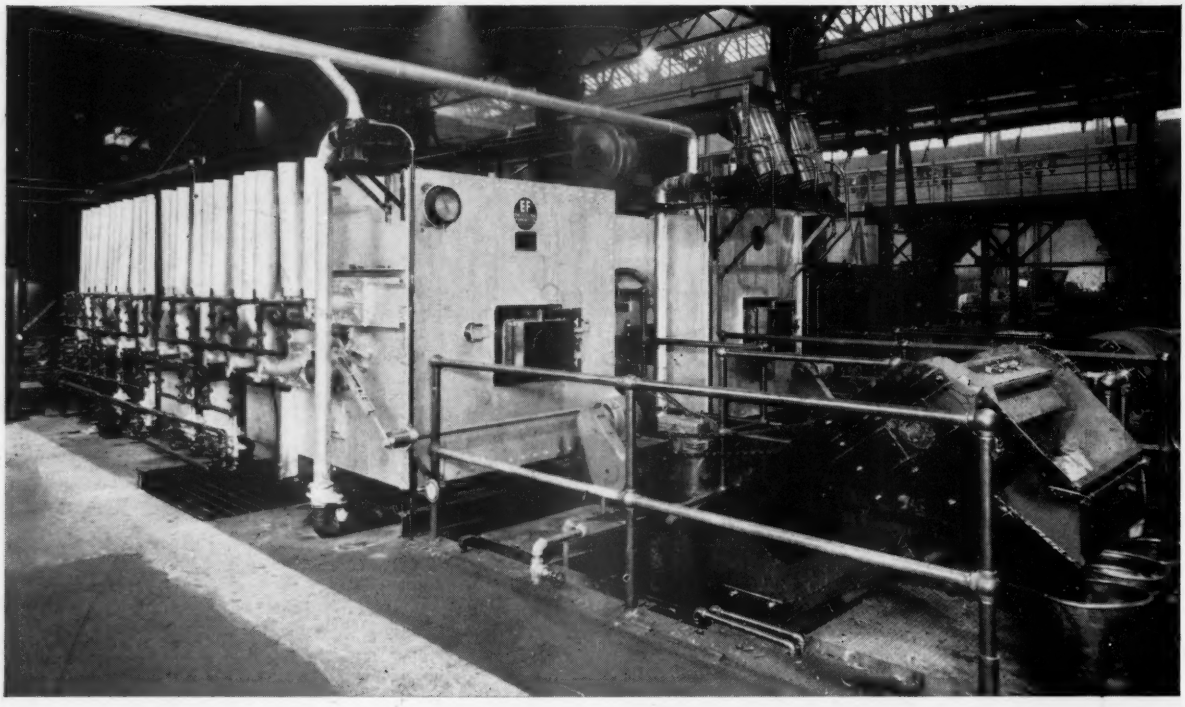
● There's more to present day engineering and design problems than shortages of materials, priorities, etc. There is also the question of whether specifications have been rigidly adhered to. Wire, for example, must meet such requirements as specific electrical properties, flexibility, tensile strength, laying speed, uniformity, etc.

Whether it's a buyer's or a seller's market, WINCO magnet wire products are drawn to exact specifications. Uniformity of product is guaranteed by mercury process tests and careful supervision guards against variations in consistency, structure or electrical values.

If you have a wire problem, our complete facilities are at your disposal. Send blueprints or specifications for recommendations, without obligation. Samples sent on request; write today.

WINSTED DIVISION

WINSTED HUDSON WIRE COMPANY CONNECTICUT



EF Gas Fired Radiant Tube Chain Belt Conveyor Furnaces

For Scale-Free Hardening Miscellaneous Products 300 to 1700 lbs. per hour—continuously

The above gas fired radiant tube furnace is one of three continuous chain belt conveyor type furnaces we installed in one prominent midwestern plant for scale-free hardening their small and medium size parts and products.

Products being treated in EF Chain Belt Furnaces, include:

Cap screws
Bolts and nuts
Flat springs
Sprockets
Coil springs
Small forgings
Valve springs
Spring plates
Tractor links
Gears and pinions
Rivets and washers
Wrench and tool parts
Bearing parts—cups and cones
Machine gun cartridge clips
Aircraft engine parts
Automotive parts
Rock bits, etc.

EF continuous chain belt conveyor furnaces may be oil fired, gas fired, or electrically heated. They are built in 5 standard sizes with capacities ranging from 300 to 1700 lbs. per hour. Larger or smaller sizes can also be furnished. Any size or type can be built for using special protective atmospheres for heat treating without scale or decarburization.

EF chain belt furnaces are handling all kinds of parts and products ranging in size from small bolts and springs up to large crawler links for tanks and tractors. Hundreds of installations are in operation handling such products as listed at left.

The chain belt conveyor type furnace is one of the most satisfactory and dependable general purpose heat treating machines built for the continuous, uniform, economical, production heat treatment of miscellaneous small and medium sized parts and products.

The chain belt conveyor furnace is only one of the numerous types we build. Wire, tubing, strip, castings, forgings, stampings, aircraft and aircraft engine parts, tank and truck parts, and many other products are being uniformly treated in other types of production furnaces we have built.

Telephone 4661 Salem, Ohio, or write us regarding your furnace problems. We specialize on building production furnaces — oil fired, gas fired, or electrically heated.

Send for circulars showing the chain belt and other types of EF production furnaces

The Electric Furnace Co., Salem, Ohio

Gas Fired, Oil Fired and Electric Furnaces---For Any Process, Product or Production